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WATER QUALITY AND WASTE SOURCE INVESTIGATIONS. MISSOURI RIVER AND KANSAS RIVER, KANSAS CITY, KANSAS

National Field Investigations Center
Denver, Colorado

April 1973

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Report On

WATER QUALITY AND WASTE SOURCE INVESTIGATIONS MISSOURI RIVER AND KANSAS RIVER KANSAS CITY, KANSAS

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National Field Investigations Center-Denver
Denver, Colorado
and
Region VII, Kansas City, Missouri

April 1973

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GLOSSARY OF TERMS

BOD - Biochemical Oxygen Demand, 5-day

COD - Chemical Oxygen Demand

DO - Dissolved Oxygen

MPN - Most Probable Number

MF - Membrane Filter

NH_3-N - Ammonia as Nitrogen

NO_3 + NO_2-N - Nitrate Nitrite as Nitrogen

TOC - Total Organic Carbon

RM - River Mileage (e.g. 367.5/4.0) with first number denoting distance from mouth of the Missouri River to the confluence with a tributary stream, and second value indicating distance upstream of mouth of the tributary stream.

Pb - Lead

Zn - Zinc

Cu - Copper

Cr - Chromium

Cd - Cadmium

Hg - Mercury

Ni - Nickel

WWTP - Wastewater Treatment Plant

N - Normal solution, one that contains 1 gram equivalent weight of solute/liter of solution.

bbl - Volume in barrels =0.159 m^3

°C - Temperature in degrees Centigrade = 5/9 (°F-32)

cfm - Flow rate given in cubic feet per minute = 0.4720 liters per second

GLOSSARY OF TERMS (Cont.)

cfs - Flow rate given in cubic feet per second = 0.0283 cubic meters per second or 28.3 liters per second

cm - Length in centimeters = 0.3937 in. or 0.03281 ft.

G - Giga, a prefix for billion = 10^9

gpd - Flow rate in gallons per day = 0.003785 m^3/day

gpm - Flow rate in gallons per minute = 0.0631 liters per second

kg - Weight in kilograms = 2.205 pounds

km - Distance in kilometers = 0.621 miles

km^2 - Area in square kilometers = 100 hectares or 0.3861 square miles

l - Volume in liters = 0.2642 gallons

m - Length in meters = 3.281 feet or 1.094 yards

M - Mega, a prefix for million = 10^6

m^3/day - Flow rate in cubic meters per day = 0.000264 million gallons per day

mgd - Flow rate in million gallons per day = 3,785 cubic meters per day

mg/l - Concentration given in milligrams per liter

μg/l - " " " micrograms " "

μmhos/cm - Unit of specific conductance (mho--the inverse of the standard unit of electrical resistance, the ohm) measured over a 1-centimeter distance, conventionally at 25°C.

ppm - Concentration given in parts per million parts

I. INTRODUCTION

A. 1957 CONFERENCE ON THE MATTER OF POLLUTION

On December 3, 1957, a Conference on the Matter of Pollution of the Missouri River and Tributary Streams, held in Kansas City, Missouri, was called by the Surgeon General of the United States.[1/] The conferees, representing the official water pollution control agencies of the States of Missouri and Kansas and the Surgeon General of the Public Health Service, found that the principal sources of pollution in the Kansas Cities metropolitan area were untreated and inadequately treated sewage and industrial wastes from Kansas City, Kansas; Kansas City, Missouri; North Kansas City, Missouri; and local industrial establishments.

The conferees agreed that the effects of the pollution were: (1) deterioration of water quality for public water supply of downstream municipalities, with associated enhancement of possible disease transmission; (2) increased concentrations of coliform and other organisms associated with human diseases that constituted a health hazard to commercial and recreational users of the river; (3) deterioration of water quality so as to prevent full employment of the river as a commercial fishery and for sport fishing; (4) impairment of water quality so as to interfere with navigation and actual and potential use of the river for many industrial uses; (5) interference with water quality so as to degrade the Missouri River area below the Kansas City metropolitan area as a wildfowl habitat; and (6) deterioration of water quality to the extent that severe sight and odor nuisances were created, resulting in serious impairment of the river as a recreational area and specifically preventing the use of various river-front sites for recreational areas and parks.

The conferees agreed that treatment works and the collection of sewage in the Kansas City metropolitan area would be completed and in operation by March 1, 1962, with the understanding that the complete separation of storm and sanitary sewage from Kansas City, Kansas, might not be effectuated until January 1, 1963. The City of Kansas City, Kansas, represented by Leo J. Moroney (representing Mayor Paul Mitchum), expressed no dissent or disagreement with the schedule.

In a letter, dated January 31, 1958, the Surgeon General recommended to the Missouri Department of Public Health and Welfare and to the Kansas State Board of Health that they take appropriate action under their State water pollution programs to ensure that contributors to such pollution within their jurisdiction take steps to meet the time schedule for remedial action unanimously agreed upon by the conferees.

B. 1960 PUBLIC HEARING

On May 18, 1960, the Secretary of Health, Education, and Welfare called a public hearing for June 13, 1960, in Kansas City, Missouri, because the remedial action recommended by the Surgeon General to secure abatement of the pollution had not been taken.[2/] On the basis of the evidence presented at the hearing the Hearing Board found, regarding interstate waters, that pollution which endangered the health or welfare of persons was occurring and that effective progress toward its abatement was not being made.

The Board recommended that certain measures should be taken to abate the pollution. With respect to Kansas City, Kansas, these recommendations were that the City should cease discharging sewage and other wastes without proper, adequate, and effective control and treatment. The City should construct and place in operation effective municipal and industrial sewage and waste collection, treatment, and disposal facilities as are necessary to abate the pollution. On or before November 15, 1960, individual industries desiring to be served by the public sewerage should inform the City of the volume and character of the waste each industry proposed to discharge to the sewer system. On or before May 1, 1961, the City should complete arrangements for financing of remedial facilities and should instruct its engineer to proceed with final plans and specifications for the facilities. On or before July 1, 1962, final plans and specifications for all remedial facilities were to be completed and submitted to the State Board of Health for review and approval, and that on or before January 1, 1963, all such remedial facilities were to be placed under contract for construction, to be completed and placed in operation within a reasonable time.

C. 1965 PROGRESS EVALUATION MEETING

On April 21, 1965, a progress evaluation meeting was held in Kansas City, Missouri.[3/] On the basis of statements made at the meeting, unanimous accord was reached between the State and Federal agencies involved, with respect to the cities comprising the Kansas City metropolitan area, stipulating that previous deadlines should be extended.

All major contracts should be let by January 1, 1966, all construction completed by January 1, 1967, and that all financial arrangements for such construction should be made within 60 days from April 21, 1965. Then, it was also agreed that the State of Kansas would recommend that the Secretary of Health, Education, and Welfare take appropriate legal action to ensure compliance.

D. STATUS PRIOR TO 1970 (FALL) SURVEY

Although primary waste treatment plants have been completed by the City of Kansas City, Kansas, and are presently operating, the waste collection system that was to be completed by March 1, 1962, remains incomplete. The Turkey Creek Interceptor sewer has been partially constructed but does not connect to the treatment plant. Part of the Argentine Interceptor sewer has been completed, but portions of the project are not yet under construction. Construction has not begun either on the Muncie Interceptor sewer or on plant enlargement and secondary treatment for the Kaw Point Wastewater Treatment Plant and District Treatment Plant Number 20, which also includes an interceptor sewer, pumping station, and force main. [Figure 1. See inside back cover.]

Because the City has failed to construct and complete its waste collection facilities, industrial and domestic wastes flow directly and indirectly (via municipal sewers and tributary streams) into the Kansas and Missouri Rivers.

Lax enforcement of the Kansas City, Kansas, Ordinance No. 42913 which requires industries connected to the City sewer system to pretreat their wastes to meet limits only for nontoxic parameters has resulted in discharge of toxic industrial wastes to the Kaw Point WWTP. These have inhibited and destroyed the organisms necessary for proper operation of the sludge digesters at the plant.

In November 1960 the citizens of Kansas City, Kansas, by popular referendum, had approved a 15 million dollar bond issue to finance construction of sewage collection and treatment facilities. Ordinance No. 42913 imposed a sewer-use fee in order to provide necessary funds for repayment of bonds issued. The total expenditures authorized by the bond issue have not been made. It is doubtful that the sewer-use fees so imposed provide sufficient income to allow full utilization of the approved bond issue.

E. 1970 SURVEY

During September 1970, Region VII of the Environmental Protection Agency (EPA) conducted an investigation of water-quality conditions and of municipal and industrial waste sources discharging to the lower 16 km (ten miles) of the Kansas River within Kansas City, Kansas.4/ Results of the investigation revealed that water quality in the Kansas River as it enters the metropolitan area was moderately degraded by the residual effects of pollution from a variety of sources in the Kansas River Basin. Discharges of municipal and industrial wastes to the lower reach further degraded the river. Concentrations of dissolved oxygen were below the minimum allowable limit, 5 mg/l, bottom sediments were anaerobic, toxic materials were present, and oil was observed on the water surface and river banks and in bottom sediments. High bacterial concentrations rendered the water unfit for use as a public water supply or for any type of recreational use.

Turkey Creek, a small tributary of the Kansas River with a watershed of 62.2 km^2 (24 square miles), was a primary source of pollution. Twenty-four outfalls were identified, in the lower eight km (five miles) of Turkey Creek, as potential sources of pollution.

As a result of the 1970 survey and the lack of action by the City of Kansas City, Kansas, to eliminate the pollution of the Kansas and Missouri Rivers, Region VII, EPA, requested that the National Field Investigations Center-Denver (NFIC-D) conduct a water-quality and waste-source survey in the Kansas City, Kansas, metropolitan area in order to determine the extent of the pollution problems. This survey was conducted from July 10 to 20, 1972 and from September 14 to October 5, 1972.

The Department of Justice, on October 6, 1972, filed a civil action pursuant to Section 1160 of Title 33 of the United States Code. This action, taken at the request of the Environmental Protection Agency, was to enjoin the City of Kansas City, Kansas, from discharging untreated and inadequately treated sewage and industrial wastes into the Kansas and Missouri Rivers.

This report documents the steps that have been taken toward fulfillment of the 1957 Conference recommendations, the recommendations of the 1960 Hearing Board, and the requirements of City Ordinance No. 42913, and provides information to support the current litigation against the City of Kansas City, Kansas.

II. SUMMARY AND CONCLUSIONS

1. In July 1972, bacteriological studies were conducted of the lower 16 km (ten miles) of the Kansas River and of the Missouri River from upstream of the confluence with the Kansas River (RM 367.5) downstream to Lexington, Missouri (RM 317). The results disclosed that the Kansas Water Quality Standards for fecal-coliform bacteria were violated at all stations in the Kansas River, from Turner Bridge (RM 367.5/9.1) downstream to the confluence with the Missouri River. The dissolved-oxygen criterion was violated at all stations from the 7th Street Bridge (RM 367.5/3.5) to the mouth of the Kansas River.

The fecal-coliform bacterial densities in the Missouri River violated Kansas and Missouri State Water Quality Standards at all stations. Bacterial survival studies demonstrated that enteric pathogens would survive for long periods of time and would be present at the intake of the Lexington, Missouri, municipal water supply, thus creating a serious health hazard. Dissolved-oxygen levels that were less than the 5 mg/l criterion were found at eight stations, including the Lexington water supply intake structure.

Salmonella was isolated at three locations in the Kansas River and seven locations in the Missouri River, including the Lexington water supply intake. The presence of *S. agona* at stations on the Kansas River and in the Missouri River downstream from the mouth of the Kansas River showed that pathogenic bacteria were contributed from sources in Kansas to the interstate waters of the Missouri River.

2. A biological study of the lower 14.5 km (nine miles) of the Kansas River, conducted in September 1972, indicated that the river was of good quality from Turner Bridge (RM 367.5/9.1) downstream to West Kansas Avenue Bridge (RM 367.5/5.8). However, it was evident from the decrease in benthos variety, the increase in sludgeworms, and the presence of organically rich stream deposits that the lower eight-km (five-mile) reach was polluted.

3. A study in 1969 demonstrated that the flesh of caged channel catfish which were exposed for four days in the Missouri and Kansas Rivers was tainted by pollution. In 1972 the tests were repeated and, with the exception of fish exposed near the Kansas City, Missouri, water supply intake (upstream of the mouth of the Kansas River), pollution again tainted the flesh to the degree that fish from all sites were unacceptably off-flavor.

4. Samples of Kansas-River water were analyzed for heavy metals. Results showed that the concentrations of copper (0.026 to 0.17 mg/l) and of cadmium (0.02 to 0.03 mg/l) approached or exceeded the toxicity threshhold for fresh-water fish and invertebrates.

Channel catfish and crayfish were exposed to the waters of the Kansas and Missouri River waters for a period of 14 to 23 days. Copper was concentrated, by a factor of nine, in the flesh of catfish exposed in the Kansas River (RM 367.5/0.2). Cadmium accumulated to a maximum of 3.6 μg/g in crayfish (tails) and 4.4 μg/g in catfish fillets that were exposed in the Missouri River (RM 367.0). Accumulation of cadmium could kill the fish: if large quantities of these fish were consumed by humans, cadmium poisoning could be the result.

5. The Kansas City, Kansas, Kaw Point Wastewater Treatment Plant has experienced several operational difficulties. According to plant personnel, if all four clarifiers are used simultaneously, the waste becomes septic due to increased detention times. Digesters have been used primarily for storage for several years because of toxic materials in the sludge. All sludge is now incinerated, although in the past, sludge was frequently discharged to the river.

The effluent is not disinfected. Fecal-coliform bacterial densities in the Missouri River increased downstream as a result of the discharge and violated the Missouri and Kansas State Water Quality Standards.

Influent and effluent concentrations averaged 412 mg/l and 355 mg/l BOD and 600 mg/l and 348 mg/l suspended solids, respectively. These levels are considerably greater than those normally found in municipal systems. The plant did not achieve primary treatment removal efficiencies normally expected for BOD and suspended solids. Additional treatment is required to reduce the waste load discharged to the river.

Settleability tests were conducted on the influent to the Kaw Point Wastewater Treatment Plant in order to determine whether treatment could be improved. The results of these studies indicate that chemical addition achieves a significant improvement in effluent quality (75 percent reduction in suspended solids and 50 percent reduction in BOD). The plant solids-handling facilities should be able to handle the additional sludge created by chemical treatment.

Approximately 60 percent of the flow and 80 percent of the BOD and suspended solids influent to the Kaw Point WWTP originate from industrial sources. The plant received an average of 54,000 kg (121,000 lb) suspended solids and 38,100 kg (83,900 lb) BOD per day. Under Ordinance No. 42913, Wilson Packing Company, Standard Rendering Company, and Owens-Corning Fiberglass Corporation contributed a total of 20 percent of the suspended solids (11,150 kg or 24,600 lb) and 33 percent of the BOD (13,000 kg or 28,600 lb) received at the Kaw Point Wastewater Treatment Plant and paid approximately $235/day (total) in treatment fees (14 percent of the treatment costs). The average cost for daily treatment at the Kaw Point plant is $1,700 (excluding capital costs). On December 12, 1972, a new Water Pollution Control Ordinance (No. 51421) established new sewer service charges and surcharge rates that will make pretreatment of high-strength industrial wastes more economical than direct discharge to the Kaw Point WWTP.

The pretreatment section of Ordinance No. 42913 has not been enforced. Toxic materials (phenols, cyanides, etc.) and high concentrations of oil and grease were discharged to the municipal sewers. Heavy metals in the Kaw Point WWTP influent were either greater than or approached concentrations specified in the Ordinance. Wastes with pH values less than five or greater than ten were discharged to the municipal sewers by the Chicago Rock Island Railroad, Owens-Corning Fiberglas Corp., Sims Barrel Company, and the Acme Plating Corporation.

6. The Kansas Water Quality Standards stipulate that all municipal wastes discharged shall receive a minimum of secondary treatment by December 31, 1975. All industrial wastes discharged will receive an equivalent treatment by December 31, 1975.

7. The City of Kansas City, Kansas, operates six township wastewater treatment plants within the corporate boundaries. Plants No. 7, 8, and 20 are primary facilities. Plant No. 8 was the only one achieving acceptable primary treatment for BOD and suspended solids. Plants No. 5, 6, and 9 (secondary plants) were removing approximately 85 percent of the BOD and suspended solids.

Digester facilities at the primary plants have been abandoned. Settled solids from the primary clarifiers at each plant are hauled to the Kaw Point Wastewater Treatment Plant for incineration.

None of the plants provide disinfection. Kansas water quality criterion for fecal-coliform bacteria was violated in Turkey Creek, Little Turkey Creek, Barber Creek, in an unnamed tributary to Turkey Creek, and the Kansas River.

8. The Kansas City, Missouri, West Side Wastewater Treatment Plant was found to be operating efficiently as a primary facility. However, the effluent was not disinfected and sustained the bacterial contamination in the Missouri River from upstream sources. The Missouri water quality criteria for bacteria are not applicable in "specified mixing zones adjacent to or downstream from waste outfall,"

or when the stream is affected by storm water run-off. The "specified mixing zone" has not been defined by the State.

9. The Johnson County Main Wastewater Treatment Plant and Turkey Creek Wastewater Treatment Plant produced a combined effluent with a BOD of 32 mg/l and suspended solids of 24 mg/l. The effluents were not adequately disinfected; however *Salmonella* were isolated in the chlorine contact chambers.

10. Sixty-six sewer outfalls were located in the lower 16 km (ten miles) of the Kansas River. Of these, 17 outfalls discharged untreated industrial or domestic wastes. During the survey the outfalls which contributed most of the pollutants were the 34th Street sewer (RM 367.5/6.6), Osage Street sewer (RM 367.5/5.5), Argentine sewer (RM 367.5/5.1), and 12th Street sewer (RM 367.5/4.4). The combined flow was estimated at 68,100 m^3/day (18 mgd), and the combined BOD and suspended solids load were 26,300 and 15,900 kg/day (58,000 and 35,000 lb/day), respectively. The Turkey Creek inflow (RM 367.5/3.4) constituted a significant source of pollution to the river.

11. Thirty-six outfalls were located in the reach of Turkey Creek from the Wyandotte-Johnson County line (RM 367.5/3.4/3.8) downstream to the confluence with the Kansas River. Ten of these outfalls discharged either domestic or industrial wastes. An estimated 7,600 m^3/day (2 mgd) of untreated domestic waste was discharged from the Turkey Creek Interceptor Stub. This waste was originally to be transported across the state line for treatment by Kansas City, Missouri.

However, completion of the interceptor has been delayed since 1964 because of a lack of agreement between the two municipalities. By the direction of the Kansas State Board of Health, the City of Kansas City, Kansas, was to arrive at a final decision on a plan of action before January 1, 1972. Currently, the city has applied for an EPA construction grant to connect this discharge to the Kaw Point Wastewater Treatment Plant before December 31, 1975.

Bacterial densities in Turkey Creek violated the Kansas water quality criterion for intermittent streams for fecal-coliform bacteria.

12. The Sims Barrel Company discharged treated industrial waste to the 12th Street sewer which flows into the Kansas River (RM 367.5/4.4). Treatment was not adequate as the waste loads discharged by the company contained high concentrations of BOD (1,400 mg/l), COD (2,800 mg/l), phenols (9.8 mg/l), heavy metals, and organic compounds.

13. The Acme Plating firm has a permit, issued by the City of Kansas City, Kansas, to discharge untreated industrial wastes to the Argentine storm sewer. The storm sewer flows into the Kansas River (RM 367.5/5.11). Concentrations of heavy metals in the company effluent were: lead, 0.28 mg/l; zinc, 4.4 mg/l; copper, 1.03 mg/l; chromium, 2.7 mg/l; cadmium, 0.45 mg/l; nickel, 2.8 mg/l; and mercury, 1.5 µg/l. These concentrations exceeded the limits of the EPA Interim Effluent Guidelines, but were within the concentrations specified by the new City Ordinance No. 51421. The concentrations of metals in the Argentine sewer discharge to the Kansas River were significant.

The company effluent also contained an average of 9.4 mg/l cyanide and had pH values as low as 2.8 (violations of the City Ordinance). The low pH combined with the large concentration of cyanide produced hazardous acidic conditions whereby hydrogen cyanide, an intensely poisonous gas, is released.

14. The Colgate-Palmolive Company discharged sanitary and process wastewater to the Osage Street sewer which discharges to the Kansas River (RM 367.5/5.5), approximately 0.8 km (one-half mile) away. Slug discharges of water treatment plant filter backwash water, containing approximately 1,650 mg/l suspended solids, were discharged daily.

15. Although the PBI-Gordon Corporation has made numerous changes in its operating procedures and wastewater discharges in order to eliminate the discharge of pesticides directly to the Kansas River (RM 367.5/1.2), pesticides were found in the effluent. The materials discharged are highly toxic to aquatic life and in small quantities can cause localized water quality problems. Pesticide concentrations and flows were less than those reported in the Refuse Act Permit Program Application.

16. The Phillips Petroleum Company industrial waste effluent is treated before discharge to the Missouri River (RM 368.9). Except for the amounts of phenols and oil and grease, the effluent met the EPA interim Effluent Guideline for a Class-D refinery. The effluent contained 1.8 kg of oil and grease/100 m^3 (6.3 lb/1000 bbl) and

0.11 kg phenols/100 m^3 0.4 lb/1,000 bbl); the Guidelines limit these constituents to 1.4 and 0.014 kg/100 m^3 (5.0 and 0.05 lb/1,000 bbl), respectively. Additional treatment is required to reduce these concentrations to limits of the guideline. Sanitary wastes are discharged to septic tanks located on company property. The septic tank effluents are discharged to the industrial waste-treatment facility before being discharged to the river.

17. The Penn Central Company, Inc., discharged oils and organic materials (spilled on the plant ground in transfer and storage operations) directly to Turkey Creek via the plant storm sewer. Containment of this waste could be accomplished by preventing oil and chemical spills on the plant grounds.

18. Sixteen storm sewers and seven sanitary outfalls discharged to Jersey Creek. Conditions in the creek from 22nd Street to 11th Street were characterized by stagnant, septic pools, scattered trash and debris, and rat-infested areas. Channel improvements and elimination of waste discharges are currently being accomplished. Because the Jersey Creek watershed includes one of the most densely populated areas in Kansas City, Kansas, the improvement of the creek must be continued in order to eliminate pollution and potential health hazards.

III. RECOMMENDATIONS

In order to eliminate the endangerment to the health and welfare of citizens of the United States, as documented herein, and to attain compliance with the Federal Water Pollution Control Act Amendments of 1972, it is recommended that:

1. Appropriate City and County officials be formally advised that the following actions are required:

   a. secondary-treatment effluent limitations for publicly owned treatment works established pursuant to the Amendments be met by December 31, 1975, and that maximum waste loads be predicated on the basis of effluent limitations (e.g. concentration of BOD and suspended solids and present design flow),

   b. the BOD and suspended solids in the effluent from the wastewater treatment plants each not exceed a monthly average of 30 mg/l and weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better water quality by December 31, 1975 (this quality of effluent being achievable through a well-operated secondary plant),

   c. the fecal-coliform bacterial density in the effluent from the wastewater-treatment plants shall not exceed a weekly average of 400/100 ml and a monthly average of 200/100 ml,

   d. owing to the high percentage of industrial wastes in the influent to the Kaw Point Wastewater Treatment Plant and to the equally high probability that toxic materials can enter the plant, concurrent biological and physical-chemical treatment process pilot-plant studies of the Kaw Point influent be conducted, to last for several months, in order to determine reliability before a full-scale plant is designed (the pilot plant studies not being used as a basis to obtain an extension of the December 31, 1975 deadline for secondary treatment),

e. in order to reduce the amount of contaminants entering the Missouri River and to upgrade the existing plant to achieve primary treatment efficiencies until a secondary plant can be put on line, the Kaw Point Wastewater Treatment Plant staff proceed immediately with testing procedures on the influent to determine possible treatment methods to remove additional amounts of BOD and suspended solids and immediately apply the results to the full-scale plant,

f. the City of Kansas City, Kansas, establish pretreatment regulations for industries discharging to the municipal sewers, thus requiring the removal of pollutants and toxic substances not susceptible to treatment or that would either interfere with the operation of the treatment works or pass through the public systems in concentrations or loads inconsistent with effluent limitations for secondary treatment plants established pursuant to the Federal Water Pollution Control Act Amendments of 1972,

g. the new Water Pollution Control Ordinance, No. 51421, should be reviewed and revised as necessary to meet the stipulations of Section 307 of the 1972 Amendments and the regulations established pursuant thereto, and the Ordinance, in its final form, be strictly enforced,

h. the City of Kansas City, Kansas, eliminate the discharge of all untreated domestic and industrial wastes, flowing through municipal sewers, to the Kansas and Missouri Rivers and their tributaries, with an implementation schedule, to establish the dates when the discharges will be eliminated, being submitted to the EPA for approval, and

i. a course of action be implemented to eliminate the continued reliance upon numerous small wastewater-treatment plants now in use and to provide for a regional treatment system;

2. The Acme Plating Corporation take immediate steps:

a. to neutralize the pH of its waste to between 6 and 8.5,

b. to reduce the cyanide concentrations of its waste to 0.1 mg/l or less, and

c. if the City of Kansas City, Kansas does not connect the Argentine sewer to a wastewater treatment facility by December 31, 1974, to reduce heavy-metal concentrations in the effluent to levels in the EPA interim Effluent Guidelines for the metal-finishing industry, based on best practicable control technology available by that date, and if the Argentine sewer is connected to a wastewater treatment plant by December 31, 1974, the effluent shall meet the limitations specified in the pretreatment guidelines established by the 1972 Amentments;

3. The PBI-Gordon Corporation conduct additional in-plant surveys to locate and eliminate the sources of chemical-pollutant entry to the company sewer system, sand the City permit the discharge of all wastes, with the exception of cooling water, to the Armourdale sewer, and if the pollutant sources cannot be eliminated, the discharge be contained in an impervious holding basin or pond and monitored for toxic materials before discharge to the City sewer, with all monitoring date being reported to the City;

4. The Phillips Petroleum Company reduce the oil and grease and phenols discharged to the Missouri River to 1.4 and 0.014 kg/100 m^3/day (5.0 and 0.05 lb/1,000 bbl/day) or less, respectively, by December 31, 1975, these values being based on best practicable control technology currently available for the petroleum industry, and that the company provide secondary treatment for its sanitary wastes or discharge those wastes to the municipal wastewater treatment plant by December 31, 1975;

5. The Penn Central Company practice good-housekeeping techniques on their grounds outside of the plant, in order to prevent oil and chemical spills from reaching Turkey Creek, with protective diking or other approved facilities being constructed to contain oil and chemical spills from damaged storage tanks, and with an implementation schedule being submitted to the EPA for approval.

IV. DESCRIPTION OF THE AREA

A. PHYSICAL DESCRIPTION

The Kansas River, formed by the confluence of the Republican and Smokey Hill Rivers near Junction City, Kansas, flows eastward for approximately 193 km (120 miles) to its confluence with the Missouri River in Kansas City, Kansas, on the Kansas-Missouri border. [Figure 1. See inside back cover.] The topography of the greater Kansas River Basin varies from rolling, semi-arid grassland in the west to steeply rolling, partially wooded farmland in the east.

The drainage area directly tributary to the lower Kansas River reach considered in this study totals approximately 171 km^3 (66 square miles), including 62 km^3 (24 square miles) in the drainage area of Turkey Creek, a tributary joining the Kansas River about 5 km (three miles) upstream of its mouth.

The topography of the Kansas City metropolitan area is characterized by hills flanking narrow flood plains along major water courses. Business districts and residential areas are primarily located on the hills with industrial districts on the flood plains. The flood plain of the Kansas River averages one-to-three km (1-2 miles) in width in Kansas City. The railroad yards of the Atchison, Topeka, and Santa Fe and Union Pacific and the Armourdale and Argentine industrial districts occupy much of this floodplain.

B. CLIMATE

The climate is typical of the central continental area, with extreme fluctuations on both temperature and annual precipitation common. Winters are generally dry and fairly mild; summers are hot with humid conditions. Recorded temperatures at Kansas City ranged from 45°C (113°F) to minus 30°C (-22°F) with a mean temperature of 13°C (55°F).[5/]

Annual precipitation averages 89 cm (35 inches) at Kansas City. Thunderstorms and tornadoes are common in the summer. Climatic extremes that range from droughts to cloudbursts-induced flash floods have been recorded. Annual runoff ranges from 20 cm (8 inches) at Kansas City to less than 1.3 cm (0.5 inches) in western Kansas.

C. HYDROLOGY

The lower Kansas River is subject to large seasonal variations in streamflow. Low-flow conditions usually occur during late summer and may extend well into the winter months. High flows occur during the spring months, primarily as the result of spring rains. At the Bonner Springs, Kansas, gaging station, located about 34 km (21 miles) upstream of the mouth of the river, the record streamflow ranged from 4.5 to 14,430 m^3/s (160 to 510,000 cfs) with an annual average of 189 m^3/s (6,663 cfs).[6/] Annual runoff averages 5.9 Gm^3 (4.8 million acre-feet). Streamflow at Bonner Springs ranged from 39 to 219 m^3/s (1,390 to 7,750 cfs) during the July 5 through 21, 1972, and from 232 to 255 m^3/s (8,200 to 9,000 cfs) during the September 18 through 24 stream surveys.

Streamflow in all of the major tributaries of the Kansas River is regulated by flood control or irrigation reservoirs. This regulation tends to reduce extreme variations in flow in the lower rivers. Runoff from uncontrolled tributaries following heavy rainfall can produce sudden increases in streamflow.

The hydrology of the Missouri River exerts an important influence on the lower Kansas River. Water surface elevations in the Missouri River are frequently higher than elevations that would normally occur in the Kansas River at its mouth under free-flowing conditions. High stages in the Missouri River produce backwater conditions in the Kansas River which cause a ponding effect with increased water depths and reduced flow velocities. High flood stages on the Missouri River can produce backwater effects extending as much as 16 km (ten miles) upstream in the Kansas River. Stream flows in the Missouri River, measured at the Kansas City gaging station, ranged from 1,470 to 2,120 m^3/s (52,000 to 75,000 cfs) during the July stream survey to between 1,980 to 3,400 m^3/s (70,000 to 120,000 cfs) during the September stream survey.

D. POPULATION AND ECONOMY

The economy of the Kansas River Basin is primarily based on agriculture. Because of the rural nature of the basin, population density is relatively low and decreases from east to west. The population of Kansas City, Kansas, was 168,000 in 1970, a substantial increase from the 1960 population of 121,900.[7/] The metropolitan area encompassing Kansas City, Missouri, Kansas City, Kansas, and other suburban communities had 1960 and 1970 populations of 597,440 and 675,300, respectively. Much of the metropolitan area growth in Kansas occurred in the suburban areas adjacent to Turkey Creek or the Kansas River.

Kansas City is an important manufacturing center; products manufactured include chemicals, paper goods, automobiles, railroad cars, petroleum products, casting and foundary materials, and dairy and agricultural commodities. Meat packing, once a major industry, has declined with only a few operations remaining.

V. APPLICABLE STANDARDS

A. KANSAS WATER QUALITY STANDARDS

The Missouri River in Kansas and the main stem of the Kansas River are used for public water supply; industrial water supply; recreation, including sport fishing; agricultural purposes; and receipt of treated wastes. The Missouri River is also used for commercial fishing. Pollutional substances are to be maintained below maximum permissible concentrations that would be detrimental to these or any other established beneficial uses. [Excerpts of Water Quality Standards for Kansas and Missouri are contained in Appendix A.]

All municipal wastes discharged within the Kansas River and Missouri River Basins shall receive at least secondary treatment in order to achieve a minimum of 85-percent reduction of the five-day BOD by December 31, 1975. All industrial wastes discharged within these basins will receive an equivalent treatment by December 31, 1975.

Specific standards applicable to this survey include:

1. The fecal-coliform bacterial densities shall not exceed 2,000/100 ml sample in waters designated for public water supply and recreation including sport fishing. In waters designated for body-contact recreation the fecal-coliform bacteria "content based on a minimum of not less than five samples taken over not more than a 30-day period, shall not exceed a log mean of 200 per 100 ml sample, nor shall more than 10 percent of total samples during any 30-day period exceed 400 per 100 ml sample."

2. "The dissolved oxygen of the river shall be maintained at or above 5 mg/l. Dissolved oxygen concentrations less than 5 mg/l shall not be due to man-made waste discharges."
3. "The river shall be free of floating debris, scum, and other floating materials attributable to municipal, industrial, or other waste disposal practices in amounts sufficient to be unsightly or detrimental to established beneficial use."
4. "Taste and odor producing substances for man-made sources shall be limited to concentrations in the river that will not interfere with the production of potable water by reasonable water treatment processes or impart unpalatable flavor to fish, or result in noticeable offensive odors in the vicinity of the water, or otherwise interfere with established beneficial use of the river."
5. "All waste discharges to tributaries of the Kansas river shall be controlled so that the quality of the water will not be reduced beyond the limits of established criteria. In intermittent stream waters, the fecal coliform shall not exceed 4,000 per 100 ml sample. Tributaries shall additionally be controlled so that public health hazards or nuisance conditions will not develop within tributary streams or drainage courses."

B. MISSOURI WATER QUALITY STANDARDS

The Missouri Water Pollution Board prohibits the discharge of all municipal, industrial, agricultural, and mining effluents that would adversely affect either the present or future water uses as they become current. The Missouri River is used for public and industrial water supply, agricultural purposes, recreation, and commercial and sport fishing.

Specific water quality standards applicable to this survey include:

1. The concentration of dissolved oxygen shall be maintained at a minimum 5.0 mg/l or greater.
2. The fecal-coliform bacterial densities shall not exceed 2,000/100 ml (either MPN or MF count), except in specified mixing zones adjacent to or downstream from waste outfalls. These criteria shall not be applicable when the stream is affected by storm water runoff. [The Missouri Water Pollution Board has not defined the "specified mixing zone."]
3. "Taste and odor producing substances discharged shall be limited to concentrations in the stream that will not interfere with the production of potable water by reasonable waste treatment processes, or impart unpalatable flavor to food fish, or result in noticeable offensive odors in the vicinity of the water, or otherwise interfere with the reasonable use of the water."

VI. STREAM SURVEY

In July, September, and October 1972, EPA investigators conducted surveys on the Kansas and Missouri Rivers to determine effects of waste discharges on water quality. A bacteriological survey was carried out in two phases. Phase I, July 10-15, included examination of the Kansas River from the Turner Bridge (RM 367.5/9.1) to its confluence with the Missouri River and the portion of the Missouri River from the Jersey Creek confluence (RM 368.2) downstream to the Armour-Swift-Burlington (ASB) Bridge (RM 365.5). Phase II, July 16-20, covered the reach of the Missouri River from the ASB Bridge downstream to Lexington, Missouri (RM 317). A limited biological investigation of the lower 14 km (nine miles) of the Kansas River was made in September. Chain-of-custody procedures [Appendix E] were followed for samples as needed.

A. KANSAS RIVER

Bacteriological Conditions

In order to ascertain both the dispersion of wastes in the receiving waters and the mixing pattern of the Kansas River and Jersey Creek with the Missouri River, several dye releases were made in conjunction with the bacteriological studies. [Dye studies are discussed in detail in Appendix L.] These dye studies revealed that the Kansas River water mixed only to the mid-channel of the Missouri River; that the Kaw Point WWTP (Kansas City, Kansas) discharge stayed along the south bank of the Missouri River and gradually mixed to one-third point of the channel at the Broadway Street Bridge (RM 366.2); and that the West Side WWTP

(Kansas City, Missouri) discharge mixed out to one-fourth point of the channel of the Missouri River downstream at the Broadway Street Bridge. The flow pattern of the West Side WWTP discharge was different than that of the Kaw Point WWTP discharge.

Following the results of the dye studies, twenty sampling stations [Figure VI-1] were established in the Kansas and Missouri Rivers from the Turner Memorial Bridge (RM 367.5/9.1) on the Kansas River downstream to its confluence with the Missouri River and at three locations on the Missouri River: upstream of the Jersey Creek confluence, downstream, and across the Kansas-Missouri State Line to the ASB Bridge. Sample stations were also established in Turkey Creek, a tributary of the Kansas River, and in Jersey Creek, a tributary of the Missouri River.

Grab samples were collected daily from the stream stations and analyzed for total- and fecal-coliform bacteria and fecal streptococci. Field determinations of conductivity, pH, and temperature were performed daily at each station [Table P-1, Appendix P]. Analyses for pathogenic *Salmonella* bacteria were performed at ten stream locations [Figure VI-1].

At all stations in the Kansas River, fecal-coliform bacterial densities were in violation of the Kansas Water Quality Standards* [Figure VI-1; Table P-2, Appendix P].

Polluted stream flow from Turkey Creek (RM 367.5/3.4/0.1) contributed to the degradation of the water quality of the Kansas River. This tributary had a range of fecal-coliform bacterial densities from 63,000

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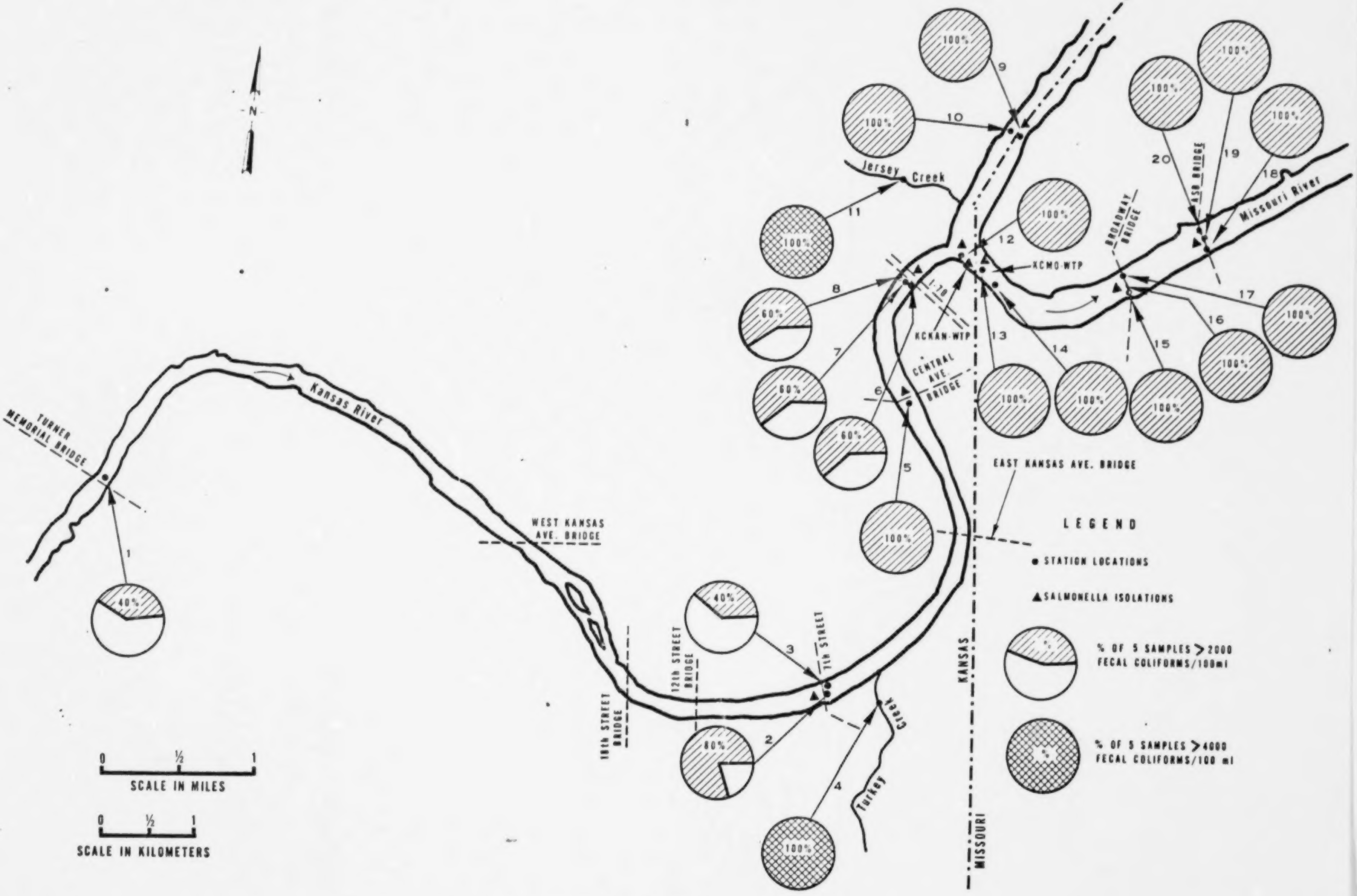
* The Kansas Water Quality Standards read: "Fecal coliform content shall not exceed 2,000/100 ml sample."


N
TURNER MEMORIAL BRIDGE
Kansas River
WEST KANSAS AVE. BRIDGE
18th STREET BRIDGE
12th STREET BRIDGE
7th STREET
Turkey Creek
CENTRAL AVE. BRIDGE
1-70
KCKAN-WTP
KCMO-WTP
Jersey Creek
BROADWAY BRIDGE
ASB BRIDGE
Missouri River
EAST KANSAS AVE. BRIDGE
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LEGEND
● STATION LOCATIONS
▲ SALMONELLA ISOLATIONS
% OF 5 SAMPLES > 2000 FECAL COLIFORMS/100ml
% OF 5 SAMPLES > 4000 FECAL COLIFORMS/100 ml
0 ½ 1
SCALE IN MILES
0 ½ 1
SCALE IN KILOMETERS

Figure VI-1. Sampling Locations at which Bacterial Densities Exceeded Kansas and Missouri Water Quality Standards Kansas City Area July 10-15, 1972

to 520,000/100 ml, a violation of the Kansas bacterial criterion.*

Pathogenic *Salmonella* bacteria were isolated at three stations, Nos. 2, 5, and 6, in the Kansas River [Table VI-1]. The presence of pathogens at these stations, in addition to the excessive fecal-coliform bacterial densities, indicates the presence of a public health hazard.

Fecal-coliform bacterial densities were in excess of 2,000/100 ml in all samples collected at Stations No. 9 and 10 in the Missouri River, upstream of the mouth of the Kansas River. *Salmonella senftenberg* and *S. newport* were isolated from Station No. 10. Additional degradation of Missouri River water quality resulted from the Jersey Creek inflow (RM 368.2). The fecal-coliform bacterial densities ranged from 820,000 to 4,700,000/100 ml in samples collected from Jersey Creek (RM 368.2/0.1) and exceeded the Kansas bacterial standard.**

Bacterial levels at the station located downstream from the mouth of the Kansas River (RM 367.3) violated the Kansas fecal-coliform bacterial criterion. The Kansas City, Kansas, Kaw Point WWTP effluent (RM 367.25) further degraded the Missouri River. At Station No. 13, immediately downstream from the Kaw Point discharge and Kansas-Missouri state line (RM 367.2), the density of fecal-coliform bacteria (range: 28,000 to 850,000/100 ml) was in violation of Missouri Water Quality Standards. The bacterial densities downstream (RM 366.8) from the Kansas City, Missouri, West Side WWTP discharge (RM 367) also exceeded

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* The Kansas Water Quality Standards read: "Tributaries to the Kansas River. In intermittent stream waters, the fecal coliform shall not exceed 4,000/100 ml sample."

** The Kansas Water Quality Standards read: "Tributaries to the Missouri River. In intermittent stream waters, the fecal coliform shall not exceed 4,000/100 ml sample."

TABLE VI-1

SALMONELLA ISOLATIONS FROM KANSAS AND MISSOURI RIVERS JULY 10-15, 1972

Station No.	Station Description	River Mileage	Serotype(s) Isolated
2	Kansas River at 7th Street Bridge, 1/3 distance from south bank.	367.5/3.5	*Salmonella agona*
5	Kansas River at Central Avenue Bridge, mid-channel.	367.5/1.1	*S. agona* *S. muenchen* *S. taksony*
6	Kansas River at I-70 Bridge, 1/4 distance from east bank.	367.5/0.2	*S. senftenberg*
10[a/]	Missouri River upstream of the mouth of the Kansas River, 2/3 distance from east bank.	369.0	*S. senftenberg* *S. newport*
12	Missouri River downstream from mouth of Kansas River.	367.3	*S. agona* *S. anatum* *S. bredeney* *S. montevideo*
12A	Missouri River at Kansas City, Kansas, WWTP discharge.	367.25	*S. derby*
13	Missouri River downstream from Kansas City, Kansas, WWTP discharge.	367.2	*S. eimsbuettel* *S. lexington* *S. newport* *S. oranienburg* *S. thomasville*
15	Missouri River downstream from the Kansas City, Missouri West Side WWTP discharge at the Broadway Bridge, 1/4 distance from south bank.	366.2	*S. infantis*
16	Missouri River at the ASB Bridge, 1/2 distance from south bank.	365.5	*S. lexington*
40	Missouri River at Lexington, Missouri, water treatment plant intake.	317.0	*S. infantis* *S. meleagridis*

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a/ Analysis was performed August 15-18, 1972 the fecal-coliform bacterial criterion (range: 12,000 to 220,000/100 ml). Because of the dilution effects of the Missouri River, fecal-coliform bacterial levels had decreased at downstream Stations No. 16 to 20 but still exceeded the Missouri Standards.

Salmonella bacteria were isolated in the Missouri River upstream of the confluence with Jersey Creek and immediately downstream from the confluence of the Kansas River; at the point of discharge of the Kaw Point WWTP; and downstream from the West Side WWTP at the Broadway Street and ASB Bridge [Table VI-1]. The presence of these pathogens constitute a threat to the health of individuals in contact with Missouri River water [Appendix M]. The presence of *S. agona* at sampling stations on the Kansas River, Stations No. 2 and 5, and in the Missouri River downstream from the Kansas River (Station No. 12) indicated that pathogenic bacteria originated from sources in the State of Kansas to the interstate waters of the Missouri River.

Dissolved Oxygen

July 1972 - Dissolved-oxygen determinations were made in July at the bacteriological sampling stations. With the exception of the station at Turner Bridge (01), concentrations of dissolved oxygen [Figure VI-2; Table P-1, Appendix P] were less than 5 mg/l (a violation of Kansas Water Quality Standards) at all other stations in the Kansas River. The DO ranged from 3.1 to 6.5 mg/l in Turkey Creek (RM 367.5/3.4/0.1) and from 0 to 0.5 mg/l in Jersey Creek (RM 368.2/0.1).

September 1972 - Surface and near-bottom water samples were collected at 30 stations, during the early morning (0600-0900 hours) and the mid-afternoon (1200-1500 hours), for analysis of dissolved oxygen. These depths and time intervals were selected to determine whether or not bottom sediments were exerting a measurable oxygen demand and to measure diurnal DO fluctuations.

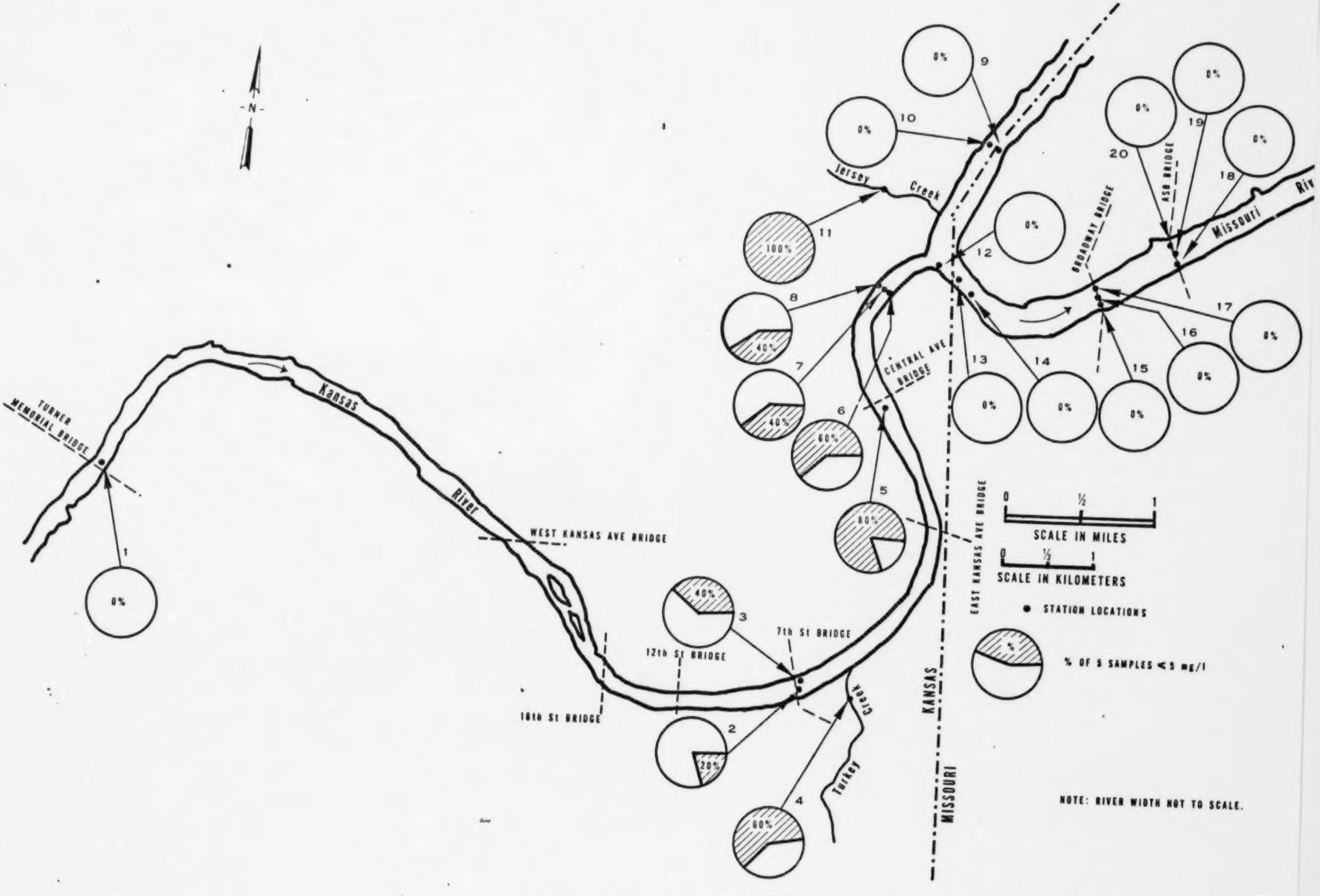
These studies did not show any DO deficiencies or significant effects of sediment oxygen demand [Figure VI-3; Tables P-3 and P-4, Appendix P]. Observed DO concentrations ranged from 6.4 to 7.5 and from 6.8 to 8.0 mg/l in the morning and afternoon studies, respectively. Precipitation in September could have contributed to the high DO concentrations.

Turbidity

One of the most striking features of the lower reach of the Kansas River is the silt load transported by the stream. Turbidity levels in the surface waters (80-190 JTU) were typical of prairie-type streams receiving runoff from agricultural lands. Generally, turbidity decreases downstream from RM 367.5/9.0 to the stream mouth [Figure VI-4]. Suspended particulate matter, carried by the stream, tended to settle out in the lower river reach.

Sediment and Benthos Characteristics

The lower portion of the Kansas River (RM 367.5/9.0 to 0.5) is characterized by reaches of shallow water, large flow fluctuations,


N
0%
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TURNER MEMORIAL BRIDGE
Kansas
River
WEST KANSAS AVE BRIDGE
18th St BRIDGE
12th St BRIDGE
7th St BRIDGE
40%
3
20%
2
60%
4
Turkey Creek
KANSAS
MISSOURI
80%
5
EAST KANSAS AVE BRIDGE
60%
6
CENTRAL AVE BRIDGE
40%
7
40%
8
100%
11
Jersey Creek
0%
10
0%
9
0%
12
0%
13
0%
14
0%
15
0%
16
0%
17
BROADWAY BRIDGE
ASB BRIDGE
0%
20
0%
19
0%
18
Missouri
Riv
0
½
1
SCALE IN MILES
0
½
1
SCALE IN KILOMETERS
● STATION LOCATIONS
%
% OF 5 SAMPLES < 5 mg/l
NOTE: RIVER WIDTH NOT TO SCALE.

Figure VI-2. Locations at which Dissolved Oxygen Violated Water Quality Standards, Kansas City Area July 10-15, 1972

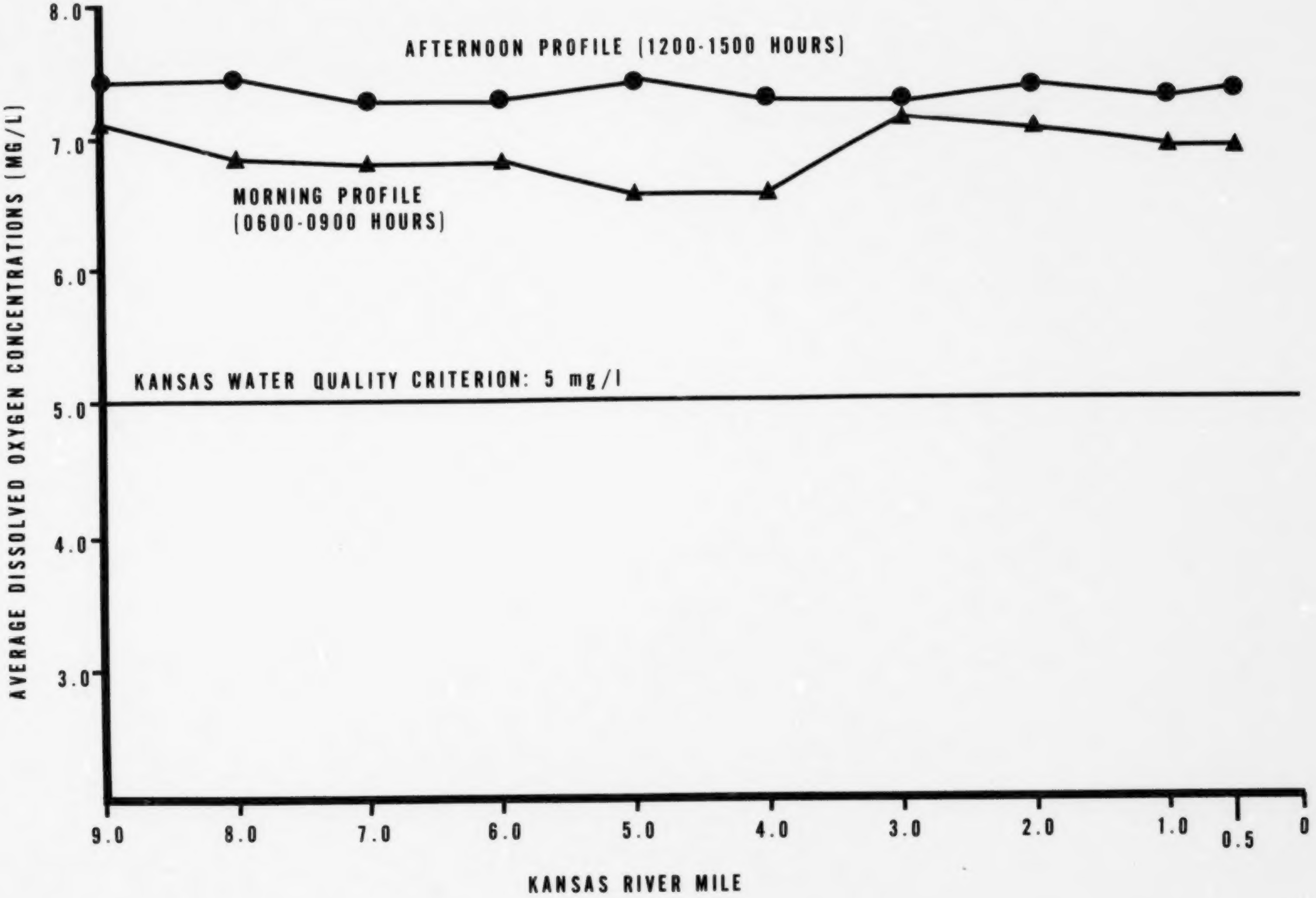

Figure VI-3. Dissolved Oxygen Profiles in the Kansas River, Kansas September 18-19, 1972

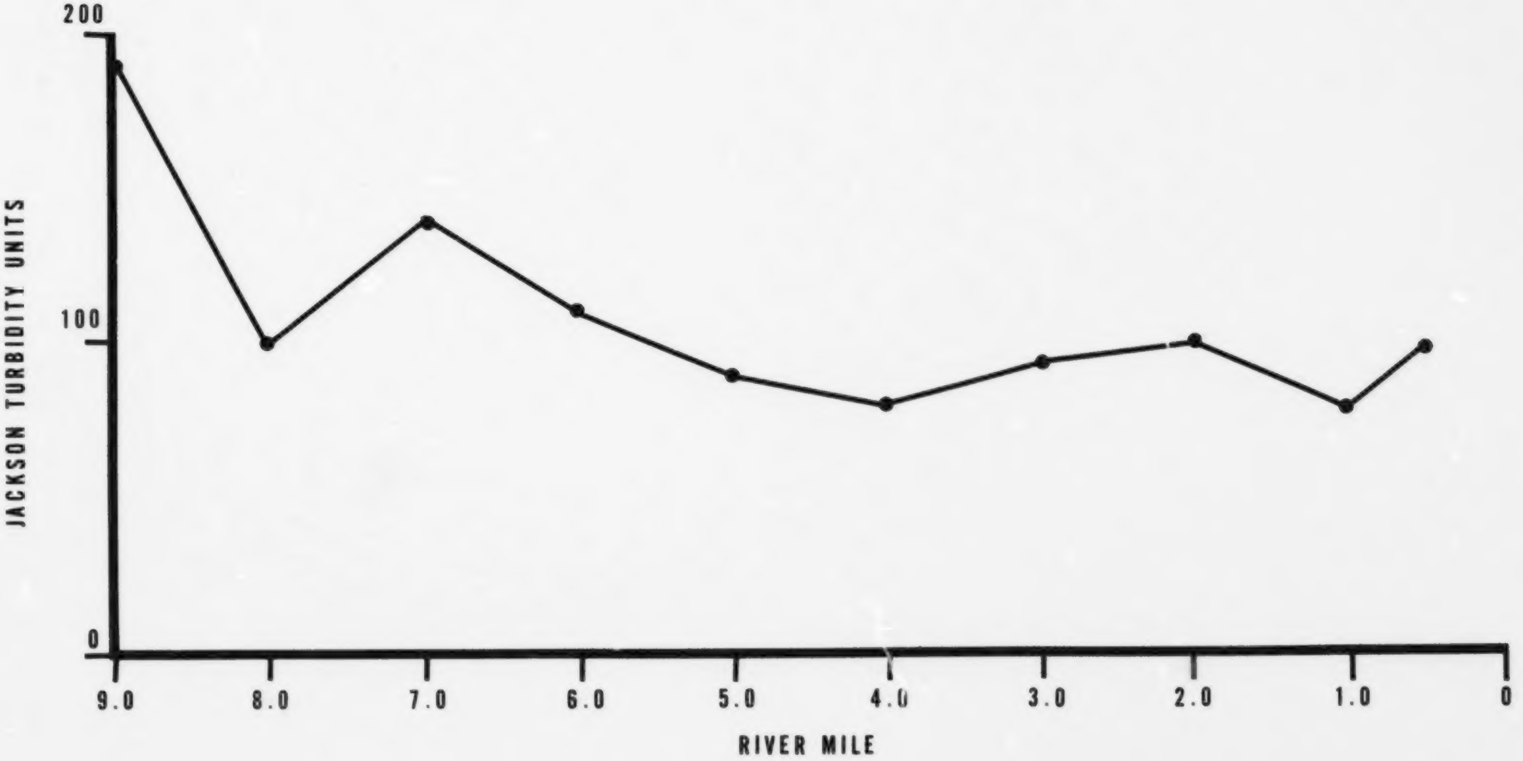

Figure VI-4. Surface Turbidity in the Kansas River, Kansas September, 1972

high turbidity, and a shifting sand-silt bottom. In combination, these conditions provide a limited habitat for benthic macroinvertebrates. The least desirable habitat for benthos appeared to be the mid-stream bottom [Table P-5, Appendix P]. Precipitation in September 1972 caused the river flows to increase, and much of the silt, clay, and detritus was scoured from the shallow channel (RM 9.0 to 6.0), leaving a substrate of sand and gravel. Exposed rock or accumulated organic detritus near the stream shoreline provided a better habitat than at mid-stream; generally, the numbers and variety of benthos were greater near the shores [Table P-5, Appendix P].

The reach of the Kansas River between RM 9.0 and 6.0 contained a flood-plain bottom deposit of sand, gravel, silt, and clay. Chemical characterization [Table P-6, Appendix P] indicated that the organic fraction, as measured by the percentage of organic nitrogen and carbon present, was typical of well stabilized sediments (<5 percent organic carbon and <0.2 percent organic nitrogen). Benthos taken from this substrate with an Ekman dredge and from shoreline dipnet collections or artificial substrate collections contained a variety of invertebrates including pollution-sensitive stone-flies, mayflies, and caddisflies [Table P-5, Appendix P]. The type of sediments and benthos found in the stream reach between RM 9.0 and 6.0 indicated that the overlying water was of good quality.

Near RM 5.5 an island divides the Kansas River into two channels. The character of the water quality, sediment, and benthos in the channel to the north of the island was similar to that found at unpolluted, upstream locations. In contrast, the channel along the south side of the island was degraded. Bottom sediments and shoreline vegetation were coated with an oily substance. Disturbance of the sediment caused an oil film to appear on the surface of the water. Examination of the river sediments disclosed the pollution source to be a ditch on the south shoreline near RM 5.1 or approximately 68 m (75 yd) downstream from the Argentine-sewer discharge. The oil pollution appeared to be limited to the shoreline near RM 5.0; other downstream locations (RM 4.0 to 0.5) gave no evidence of the oil pollution.

Benthos were apparently affected by the oil-contaminated substrate at RM 5.0 [Figure VI-5]. Clean-water organisms such as mayflies and caddisflies were virtually eliminated from the benthic community. Pollution was severe enough that even the pollution-tolerant sludgeworms were reduced in number (as much as 88 percent).

Chemical analyses of the stream sediments revealed environmental degradation in the Kansas River from RM 5.0 downstream to its confluence with the Missouri River [Table P-6, Appendix P]. In most cases the organic-nitrogen and carbon content of the sediments were more than twice as high in this lower 8-km (5-mile) reach than those found in sediments collected from upstream locations (RM 9.0 to 6.0). At RM 0.5 and 2.0 the chemical characteristics (>0.2 percent organic nitrogen) were typicalof partially stabilized sewage sludge.[8/] On the other hand, at RM 1.0, 3.0, 4.0, and 5.0 chemical characterization indicated the sediments to be more organically stable.

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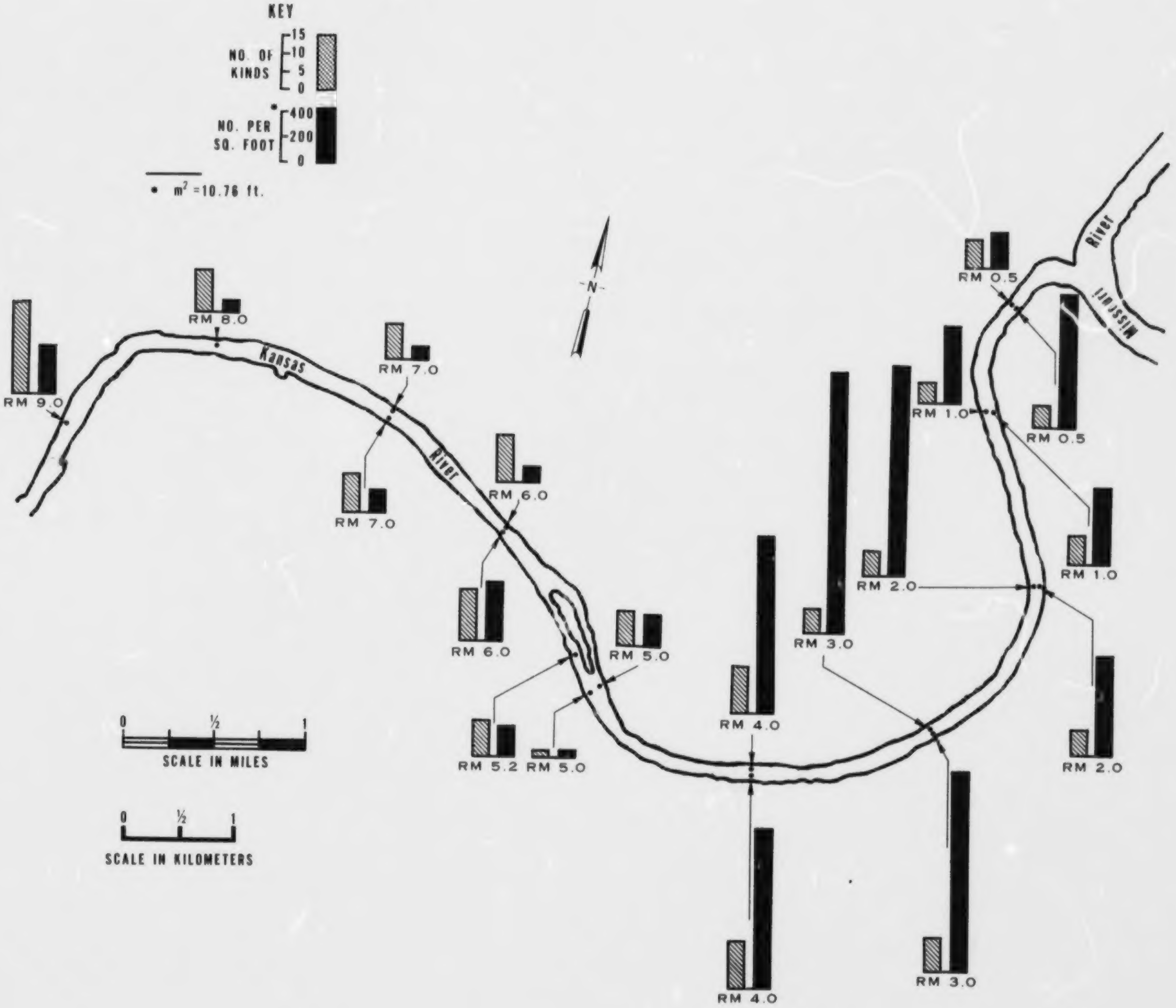
KEY
NO. OF KINDS
15
10
5
0
NO. PER SQ. FOOT*
400
200
0
* m² =10.76 ft.
N
Missouri River
Kansas River
RM 0.5
RM 0.5
RM 1.0
RM 1.0
RM 2.0
RM 2.0
RM 3.0
RM 3.0
RM 4.0
RM 4.0
RM 5.0
RM 5.0
RM 5.2
RM 6.0
RM 6.0
RM 7.0
RM 7.0
RM 8.0
RM 9.0
0
½
1
SCALE IN MILES
0
½
1
SCALE IN KILOMETERS

Figure VI-5. Relative Abundance of Benthos in the Kansas River, Kansas-September 1972

Other evidence of pollution was shown by changes in the stream life. As previously described, oil pollution was evident at RM 5.0 which reduced or eliminated many kinds of aquatic organisms. From RM 4.0 downstream to the confluence of the Kansas and Missouri Rivers the population of pollution-tolerant sludgeworms increased sharply [Table P-5, Appendix P]. Concomitant with the continued reduction in kinds of cleanwater benthos, these conditions indicated that the lower 8 km (5-mile) reach of the Kansas River was polluted.

Previous studies [4,9] have found extensive oil pollution, sludge deposits, and septic conditions in the lower 8-km (5-miles) of the Kansas River. In 1966[9] the benthic population in this reach was reported to consist of less than four kinds, with sludgeworms accounting for the bulk of the organisms (as many as $284,000/m^2$ or $26,400/ft^2$). These conditions indicated gross pollution in the Kansas River.

The September 1972 study showed evidence of marked changes in the environment of the lower Kansas River. Sludge deposits were much less extensive than reported in 1966 [Table P-3 and P-4, Appendix P]. Oil pollution was detected but was limited to the shoreline near RM 5.0. Also, the aquatic life of the lower river reach has improved since 1966 but continues to reflect pollution.

Fish Flavor

Studies were conducted, in 1969[10] and 1972, to determine the effect of pollutants on fish flavor. Channel catfish, an important resident species, were exposed in cages for 72 hr (September 1972) at sites upstream and downstream from significant waste discharges. After exposure, the fish were removed from the water, dressed, quick-frozen, and submitted to a food-flavor test panel.

In 1969, caged channel catfish were exposed at five sites in the Missouri River and one site in the Kansas River. Fish from four of these sites were unacceptably off-flavor [Table VI-2].[10/] These tests were repeated in 1972 at three of the six sites used in 1969 and at a new site upstream of the Turner Bridge (RM 9.2) on the Kansas River. With the exception of fish exposed near the Kansas City, Missouri, water intake (RM 370.4) upstream of the Kansas River, fish from all sites were unacceptably off-flavor.

Heavy Metals

In October 1972, samples of water from the Kansas River were analyzed for selected heavy metals of lead, zinc, copper, chromium, cadmium, and mercury [Appendix C, Tables C-10 and C-12]. The concentrations of copper (0.026 to 0.17 mg/l)* and cadmium (0.01 to 0.04 mg/l)* approached the toxicity threshold for fresh-water fish and invertebrates.[11,12,13/]

In order to evaluate the biological magnification of metal pollutants, in the fall of 1972, channel catfish and crayfish were placed

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* The National Surveillance Network has previously reported equivalent concentrations of copper and cadmium in the Kansas River at De Soto, Kansas, and in the Missouri River at Kansas City, Missouri, and Missouri City, Missouri [data available from STORET].

TABLE VI-2

OFF-FLAVOR AND DESIRABILITY SCORES OF CAGED CHANNEL CATFISH MISSOURI RIVER, 1969 and 1972

River Mile	Bank[a]	Location	Flavor	Score[b]
			1969[10]	1972
370.4	R	Kansas City, MO water intake	5.5	5.25
370.0	L	Downstream from Fairfax Dump	3.6	
367.8	L	Upstream of Kansas River	5.5	
367.5/0.5	L	Kansas River	2.9	4.93
367.5/9.2	L	Kansas River upstream of Turner Bridge		4.63
366.6	L	Downstream from Kansas River confluence and downstream from Kansas City, Mo. and Kansas City, Kan. WWTP	3.9	3.79
364.2	L	Downstream from Kansas River and Kansas City, Mo. and Kansas City, Kan. Sewage Discharge.	4.6	

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[a] R indicates right river bank facing upstream; L the left river bank facing upstream.

[b] Scores of less than 5.0 represent unacceptable flavor.

in submerged cages at four locations in the Kansas and Missouri Rivers. The comparison [Table VI-3] made between concentrations of heavy metals detected in the flesh of test animals (fish and crayfish exposed to the Kansas or Missouri River waters) and those found in a reference sample (fish and crayfish not exposed to the Kansas or Missouri River waters) yields the following results: after the exposure test the flesh of both the crayfish and the catfish were tainted with copper and cadmium; compared with reference samples, there was a nine-fold increase in the copper that was concentrated in the flesh of catfish after an 18-day exposure in the lower Kansas River (RM 0.2); the concentration of cadmium increased about 80 percent in crayfish (tails) and 22 percent in catfish (flesh) after exposure in the Missouri River (RM 367.0). These concentrations (copper and cadmium) can impart off-flavor to fish and render them undesirable for human consumption. Continued accumulation of cadmium could kill fish, or consumption of large quantities of these fish by humans could result in cadmium poisoning.

B. MISSOURI RIVER

Bacteriological Conditions

Twenty-two sampling stations were selected on the Missouri River between the ASB Bridge (RM 365.5) and the intake (RM 317.0) of the Lexington, Missouri, water-supply-treatment plant and on the major tributaries [Figure VI-6]. Precipitation occurred during July 16 through 17, 1972. The effects of the resultant surface runoff on

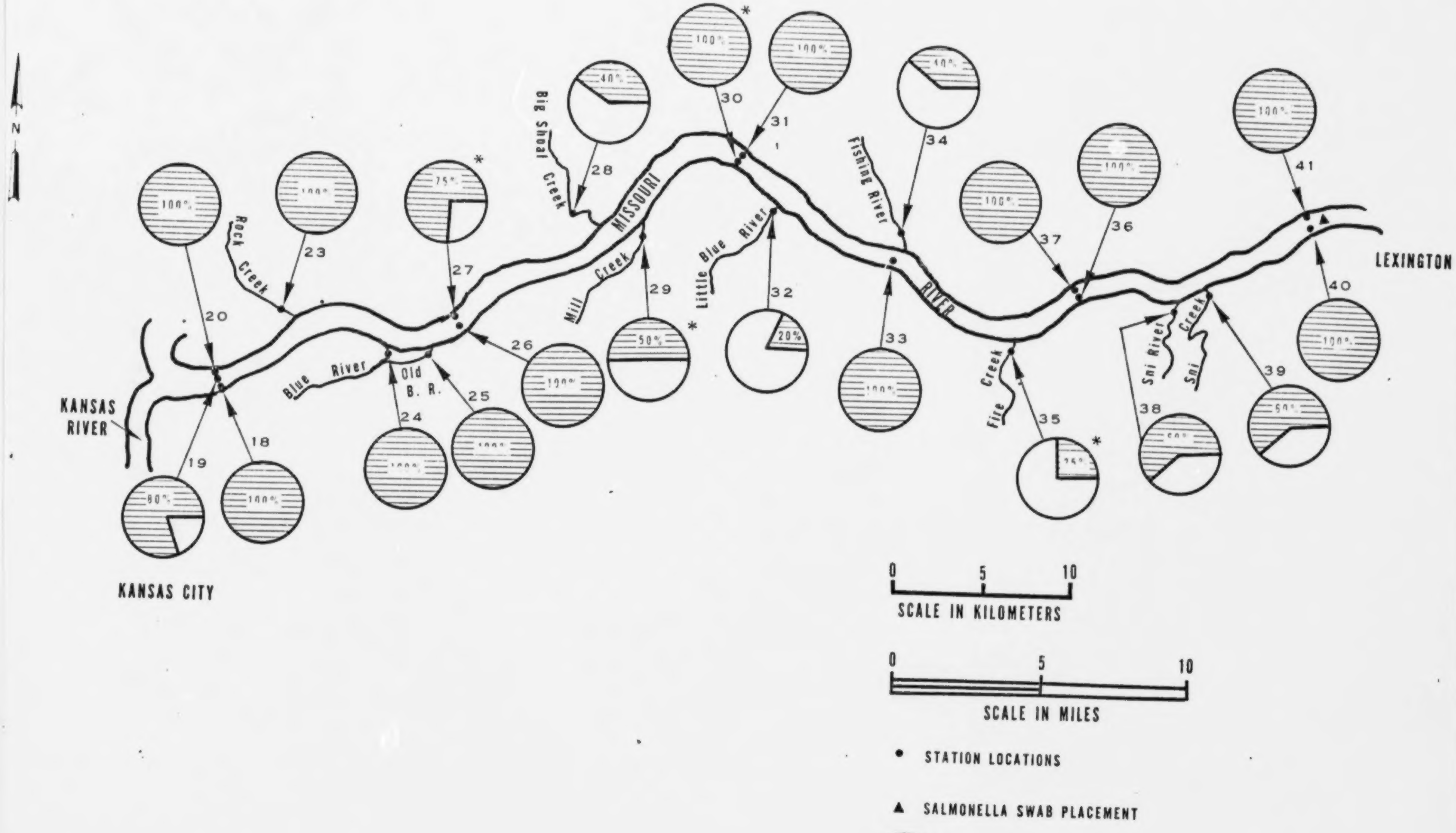

N
KANSAS RIVER
KANSAS CITY
Rock Creek
Blue River
Old B. R.
Big Shoal Creek
MISSOURI
Mill Creek
Little Blue River
Fishing River
RIVER
Fire Creek
Sni River
Sni Creek
LEXINGTON
18
19
20
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
80%
100%
75%
40%
50%
20%
25%
*
0
5
10
SCALE IN KILOMETERS
0
5
10
SCALE IN MILES
● STATION LOCATIONS
▲ SALMONELLA SWAB PLACEMENT
% OF 5 SAMPLES>2,000 FECAL COLIFORMS / 100 ml
% OF 4 SAMPLES>2,000 FECAL COLIFORMS / 100 ml

Figure VI-6. Sampling Locations at which Bacterial Densities Exceeded Kansas and Missouri Water Quality Standards

Kansas City, Missouri to Lexington, Missouri

July 16–20, 1972

TABLE VI-3

CONCENTRATIONS OF METALS IN FISH AND CRAYFISH EXPOSED IN KANSAS AND MISSOURI RIVERS KANSAS CITY, 1972

Source	River Mile	Exposure (days)	Concentration (µg/g)					
			Lead	Zinc	Copper	Chromium	Cadmium	Mercury
Crayfish tails								
Reference			<3.0	10.0-13.0	3.3-3.4	<2.5	2.0-2.3	<0.02
Kansas River	9.2	23	<3.0	13.0	1.8	<2.5	2.0	<0.02
	0.2	14	<3.0	10.0	4.6	<2.5	2.8	<0.02
Missouri River	370.5	14	<3.0	12.0	6.9	<2.5	2.6	<0.02
	367.0	14	<3.0	8.0	6.3	<2.5	3.6	<0.02
Catfish fillets								
Reference			<3.0		0.7	<2.5	3.6	<0.02
Kansas River	9.2	18	<3.0		0.9	<2.5	3.5	<0.02
	0.2	18	<3.0		6.5	<2.5	3.4	<0.02
Missouri River	370.5				(Caged fish lost)			
	367.0	18	<3.0		1.0	<2.5	4.4	<0.02
Detection Limit			3.0	1.0	0.2	2.5	0.7	0.02

bacterial densities were evident [Appendix G].

As was the case in the Phase I study, bacterial densities from Stations No. 18, 19, and 20 (ASB Bridge) violated the Missouri criterion for fecal-coliform bacteria [Figure VI-6; Table P-7, Appendix P]. Furthermore, violations of the fecal-coliform bacteria criterion occurred at all stations in the Missouri River and at all tributary stations.

Waters of Rock Creek (RM 362.6/0.1), the Blue River (RM 358/0.2), and the channel of the Old Blue River (RM 356.7/0.1) contributed to the bacterial degradation of the Missouri River [Figure VI-7]. Effects of these tributaries on the water quality of the Missouri River were measured at RM 356 (Station No. 26 and 27). The log-mean fecal coliform densities were 12,000 and 4,800/100 ml, respectively.

The remaining tributaries sampled were of better quality than those mentioned previously. However, coliform bacterial levels continued to remain high and violated the Missouri Water Quality Standards.

At the Lexington, Missouri, water-supply intake, fecal-coliform bacterial densities ranged from 3,900 to 58,000/100 ml. *Salmonella infantis* and *S. meleagrides* were isolated at Station No. 40 [Table VI-1]. The presence of any pathogen in a municipal-drinking-water supply constitutes a severe health hazard.

Dissolved Oxygen

In July 1972 the dissolved-oxygen concentration was below 5 mg/l

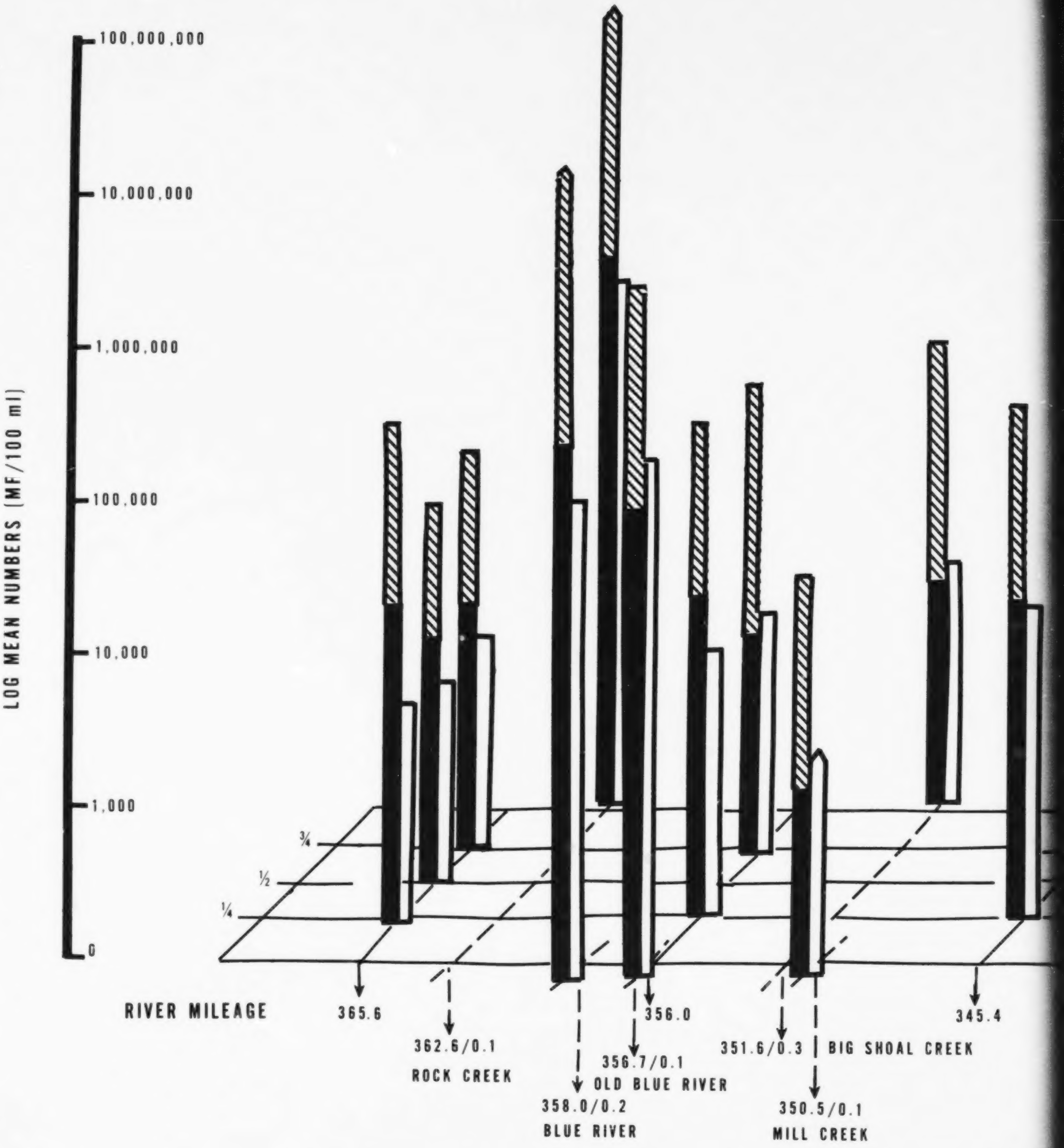
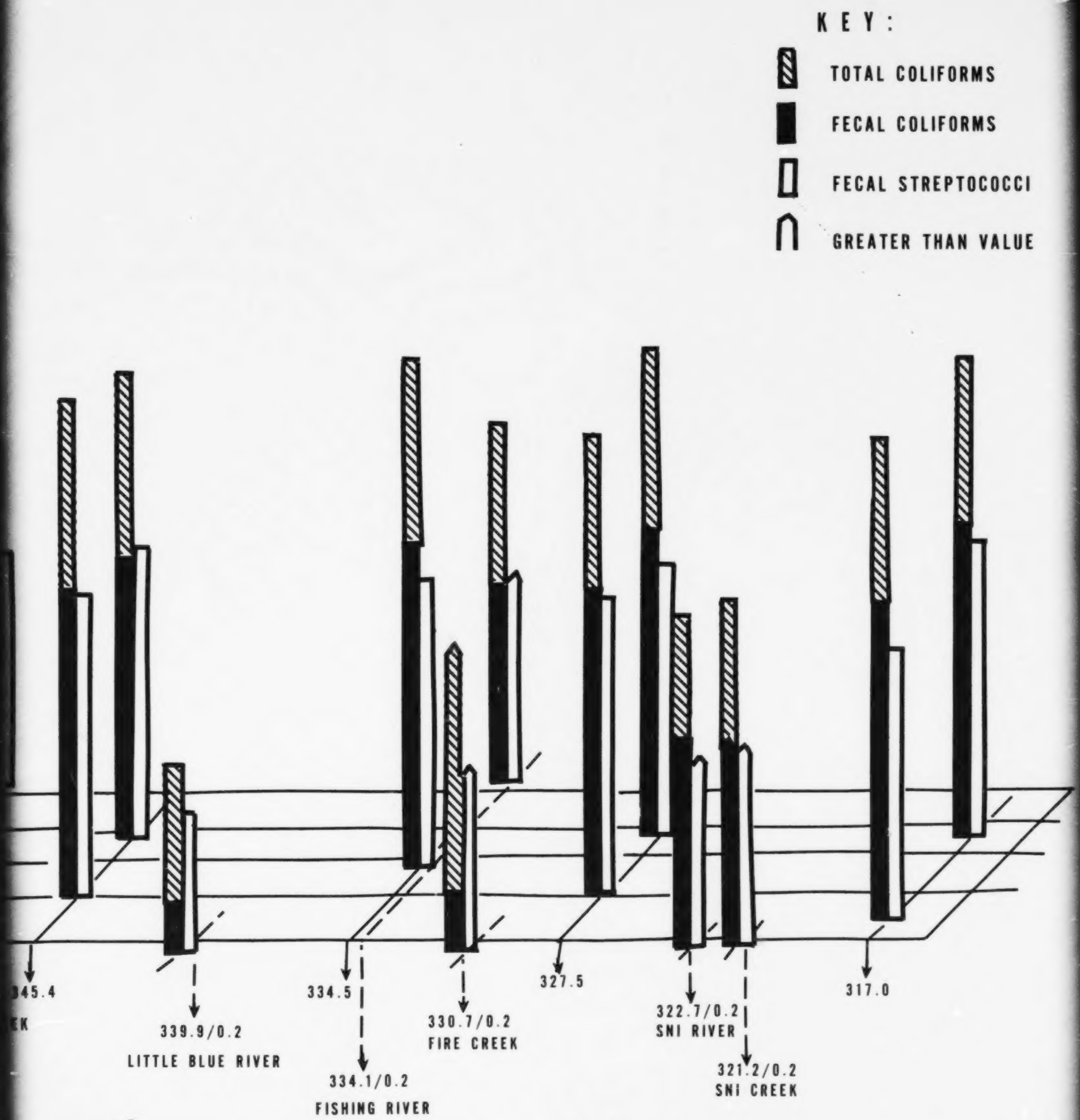


Figure VI-7. Bacterial Densities – Missouri River and Tributaries



ibutaries Kansas City to Lexington, Mo. July 16 – 20, 1972

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(violation of Missouri Water Quality Standards) in eight stations in the Missouri River from the ASB Bridge (RM 365.5) downstream to Lexington (RM 317) [Figure VI-8; Table P-8, Appendix P]. Forty percent of the samples from Stations No. 40 and 41 (adjacent to the Lexington water supply intake) had DO levels of less than 5 mg/l.

Three tributaries, Rock Creek, Blue River, and the channel of the Old Blue River, each had 80 percent of the DO samples less than 5 mg/l.

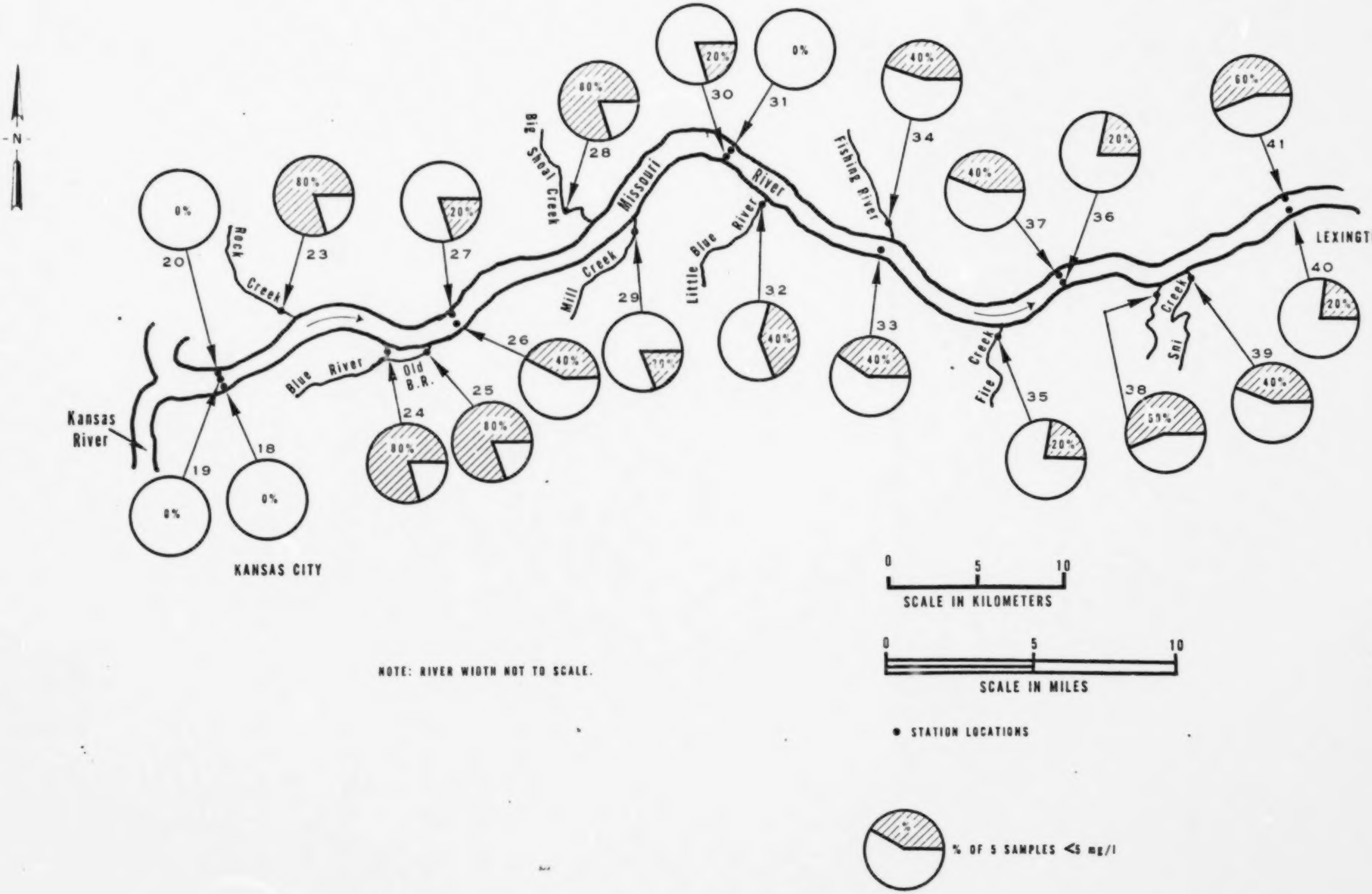
N
Kansas River
KANSAS CITY
Rock Creek
Blue River
Old B.R.
Big Shoal Creek
Mill Creek
Missouri River
Little Blue River
Fishing River
Fire Creek
Sni Creek
LEXINGTON
18
0%
19
0%
20
0%
23
80%
24
80%
25
80%
26
40%
27
20%
28
80%
29
20%
30
20%
31
0%
32
40%
33
40%
34
40%
35
20%
36
20%
37
40%
38
60%
39
40%
40
20%
41
60%
NOTE: RIVER WIDTH NOT TO SCALE.
0
5
10
SCALE IN KILOMETERS
0
5
10
SCALE IN MILES
● STATION LOCATIONS
%
% OF 5 SAMPLES <5 mg/l

Figure VI-8. Locations at which Dissolved Oxygen Violated Water Quality Standards, Kansas City, Missouri to Lexington, Missouri
July 16-20, 1972

VII. WASTE SOURCES

Waste-source investigations were conducted in the Kansas City metropolitan area to determine the quantity and quality of wastes discharged to the Kansas and Missouri Rivers and their tributaries, evaluate the adequacy of present treatment practices, and document direct discharges of untreated domestic and industrial wastes to the receiving streams. Ten municipal wastewater treatment plants and eleven industries were included in the investigations. [Individual reports for each municipal wastewater treatment plant and industry are summarized in Appendices B and C, respectively. The location of the wastewater treatment plants, industries, and four sewer outfalls discharging directly to the Kansas River are shown in Figure 1. See inside back cover.]

A. MUNICIPAL WASTEWATER TREATMENT PLANTS

Discharges to the Missouri River

The Kaw Point Wastewater Treatment Plant (Kansas City, Kansas) and the West Side Wastewater Treatment Plant (Kansas City, Missouri), both primary treatment facilities, are located within 0.5 km (1/3 mile) of each other in the Woodswether Industrial District. The Kaw Point WWTP has six sludge digesters, but they are used for sludge-storage, instead of digestion, purposes. The West Side WWTP pumps primary sludge approximately 11 km (seven miles) to the Blue River WWTP for incineration. The Kaw Point WWTP has two 4.26 m (14-foot) diameter FLUOSOLIDS (fluidized bed) incinerators.

The overflows from the primary clarifiers at the West Side and the Kaw Point Wastewater Treatment Plants discharge directly to the Missouri River (RM 367.0 and 367.25, respectively) through submerged outfalls. Disinfection is not provided. The effluents from the two plants were analyzed for *Salmonella*. Samples from the Missouri River upstream of and downstream from the discharges were analyzed for total and fecal coliforms, fecal streptococci, and *Salmonella* bacteria [Section VI, "Stream Survey"]. *Salmonella* serotypes isolated in the Kaw Point effluent were *S. senftenberg* and *S. bornum; S. tennessee* and *S. senftenberg* were isolated in the West Side WWTP effluent [Table VII-1]. In July 1972, *S. eimsbuettel, S. lexington, S. newport, S. oranienburg,* and *S. thomasville* were isolated downstream (RM 367.20) from the Kaw Point plant outfall and upstream of the West Side outfall: *S. infantes* and *S. lexington* were isolated downstream (RM 366.2 and 365.5) from the West Side outfall [Table VI-1]. Fecal-coliform bacterial densities ranged from 3,600 to 7,500/100 ml upstream (RM 367.3) of the Kaw Point outfall, from 28,000 to 850,000/100 ml downstream from the Kaw Point outfall, and from 12,000 to 222,000/100 ml downstream from the West Side outfall [Appendix P, Table P-2]. These concentrations violate the Missouri Water Quality Standards for bacterial densities. The presence of fecal coliform bacteria and *Salmonella* constitute a threat to the health of individuals contacting Missouri River water. Bacteria survival studies [Appendix J] revealed that the bacteria persist for long periods of time, are carried over long distances in the river, and pose a serious health hazard to users of the Lexington, Missouri, (RM 317) water supply.

TABLE VII-1

SALMONELLA SEROTYPES ISOLATED IN WASTEWATER TREATMENT PLANT EFFLUENTS KANSAS CITY METROPOLITAN AREA

Station Description	Date Collected[a/]	Time Collected	*Salmonella* Serotypes Isolated
Effluent from Kaw Point WWTP	9/20/72	0829	*S. senftenberg* *S. bornum*
Effluent from Kansas City, Kansas WWTP No. 5	9/23/72	1015	*S. anatum* *S. bredeney*
Effluent from Kansas City, Kansas No. 6	9/20/72	0945	*S. anatum* *S. senftenberg*
Effluent from WWTP No. 7	9/20/72	0955	*S. derby* *S. senftenberg*
Effluent from WWTP No. 8	9/20/72	1010	*S. tennessee* *S. anatum*
Effluent from trickling filter Plant No. 9A	9/20/72	0925	*S. agona* *S. bredeney*
Effluent from lagoon WWTP No. 9B	9/20/72	0920	*S. bredeney*
Effluent from WWTP No. 20	9/20/72	0945	*S. typhimurium* *S. eimsbuettel*
Effluent from Kansas City, Missouri West Side WWTP	9/20/72	0842	*S. tennessee* *S. senftenberg*
Effluent from Johnson County Main Plant	10/11/72		*S. java* *S. senftenberg*
Effluent from Johnson County Kansas WWTP No. 5	9/27/72	0630	*S. anatum* *S. bredeney*

[a/] *Salmonella* swabs were exposed for three days.

West Side Wastewater Treatment Plant - Plant records, March through June of 1972, disclosed the following operating characteristics:

Parameter[*]	Range	Average
Flow (m^3/d)	38,000-54,100	42,900
Flow (mgd)	10.05-14.29	11.34
BOD (influent)	137-172	155
BOD (effluent)	84-118	97
Removal Efficiency (percent)	29-44	37
Suspended Solids (influent)	135-207	165
Suspended Solids (effluent)	42-62	47
Removal Efficiency (percent)	64-80	72

Data collected, from September 22 through 28, 1972, indicated that the West Side WWTP was operating efficiently, with BOD and suspended solids removal ranges of 33-52 percent and 60-68 percent, respectively. The waste loads and concentrations discharged to the river were:

Parameter[**]	Mon.-Fri.	Sat.-Sun.
Flow (m^3/d)	50,000	31,400
Flow (mgd)	13.2	8.3
BOD (mg/l)	136	50
BOD (kg/day)	6,800	1,570
BOD (lb/day)	15,000	3,460
Suspended Solids (mg/l)	80	55
Suspended Solids (kg/day)	3,990	1,720
Suspended Solids (lb/day)	8,800	3,800
Oil & Grease (mg/l), range	14-55	23-36

---

[*] Values are reported in mg/l, except where otherwise specified.

[**] [Additional, waste-constituent concentrations are listed in Tables B-14, B-15, and B-16 in Appendix B.]

The strength of the plant influent was typical for domestic wastewaters although the plant serves an extensively developed industrial and commercial area.

Kaw Point Wastewater Treatment Plant - Plant records were available for the period from January 1971 to April 1972. Operating characteristics were reported as follows:

Parameter*	January-September 1971	
	Range	Average
Flow (m^3/d)	34,820-47,690	43,900
Flow (mgd)	9.2-12.6	11.6
BOD (influent)	550-1,105	805
BOD (effluent)	364-712	515
Removal Efficiency (percent)	17-46	36
Suspended Solids (influent)	318-1,008	734
Suspended Solids (effluent)	138-512	252
Removal Efficiency (percent)	29-86	66

	October 1971-April 1972	
	Range	Average
Flow (m^3/d)	81,380-95,380	87,430
Flow (mgd)	21.5-25.2	23.1
BOD (influent)	406-669	509
BOD (effluent)	294-400	322
Removal Efficiency (percent)	31-48	37
Suspended Solids (influent)	372-619	490
Suspended Solids (effluent)	76-226	176
Removal Efficiency (percent)	56-84	64

---

* Values are monthly averages and reported in mg/1, except where otherwise specified.

The 100-percent increase in flow from October 1971 to April 1972 was caused by the connection of new interceptors to the system. The increased flow, although double that of the earlier flow, did not result in a doubling of the waste loads to the river: there was a 25-percent increase in BOD in the load discharged, from 22,590 to 28,120 kg/day (49,800 to 62,000 lb/day), and approximately a 39-percent rise in suspended solids, from 11,070 to 15,380 kg/day (24,400 to 33,900 lb/day). The average removal efficiencies remained essentially the same.

The Kaw Point influent and effluent were sampled from September 22 through 28, 1972. The plant removed from 7.5 to 21 percent of the BOD and 11.4 to 47 percent of the suspended solids. These efficiencies were less than those normally expected from primary treatment, i.e., 35 percent removal of BOD and 65 percent of suspended solids.[14/] The BOD and suspended solids in the effluent were higher than levels found in municipal systems.[14/] The waste loads and concentrations discharged were:

Parameters*	Mon.-Fri.	Sat.-Sun.
Flow (m^3/d)	101,060	71,160
Flow (mgd)	26.7	18.8
BOD (mg/l)	413	150
BOD (kg/day)	41,640	10,660
BOD (lb/day)	91,800	23,500
Suspended Solids (mg/l)	348	350
Suspended Solids (kg/day)	35,150	24,890
Suspended Solids (lb/day)	77,500	54,880
Oil & Grease (mg/l), range	35-170	58-60

---

* [Additional waste constituents are listed in Tables B-1, B-2, and B-3 in Appendix B.]

The BOD in the effluent was 355 mg/l and the suspended solids was 348 mg/l (7-day, flow-weighted mean). The figure for BOD was essentially the same as the value reported in the plant records (October 1971 to April 1972), but that for suspended solids was considerably higher.

From October 7 through 12, 1972, EPA personnel conducted jar tests on the influent to Kaw Point WWTP [Appendix H]. The results of these studies indicate that a significant improvement in effluent quality (75 percent reduction in suspended solids and 50 percent reduction in biochemical oxygen demand) could be achieved by chemical addition. The additional solids removed in the clarifiers would have to be incinerated, or disposal accomplished by other approved methods. The monthly records from October 1971 to April 1972 disclosed that the plant incinerated an average of 9.5 metric tons (10.2 tons) of dry solids a day. The centrifuges and both incinerators are currently operating 16 hr/day, 5 days/week (80 hr out of a possible 168). Therefore, it is probable that the plant could handle the additional sludge created by chemical treatment.

Although the plant serves 40,000 to 50,000 people, approximately 60 percent of the flow and 80 percent of the BOD and suspended solids come from industrial sources. The City of Kansas City, Kansas, Pollution Control Ordinance, No. 42913 [Appendix I] established sewer service charges and provided for the collection of these charges, as well as for penalties for violations (of the ordinance). On December 12, 1972, this ordinance was superseded by a new ordinance, No. 51421 [Appendix O]. A comparison of the two ordinances follows.

Under the old ordinance, industries discharging to the municipal sewer were grouped into four classes. Classes I, II, and III paid a sewer-service charge on water consumption only; Class IV industries paid an additional surcharge fee, based on a rate of one cent per pound for suspended solids for concentrations greater than 1,000 ppm.

The new ordinance groups waste dischargers into three classes. Class I includes all waste discharged containing not more than 250 mg/l of suspended solids or BOD or 375 mg/l COD. Wastewater shall not be more difficult to treat than domestic waste, and slug discharges are not allowed. Class II includes all waste discharged with suspended solids or BOD ranging from 250 to 500 mg/l and 375 to 750 mg/l of COD. Class III includes all waste discharged with suspended solids or BOD more than 500 mg/l and 750 mg/l of COD.

At the time of the survey industries were allowed to discharge high-strength wastes* into the municipal system without paying a surcharge fee, provided the suspended solids remained less than 1,000 ppm. Among the industries in Kansas City, Kansas, discharging strong wastes to the Kaw Point WWTP are Wilson Packing Company, Standard Rendering Company, and Owens-Corning Fiberglas, Corp. [Appendix C: C-I: C-II: and C-V]. Discharges from these three companies have the following waste characteristics [Appendix C, Tables C-1, C-2, and C-6].

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* Normal domestic waste has an average BOD and suspended-solids concentration of 200 and 300 mg/l, respectively.[14]

	Flow		BOD	Suspended Solids	Approx. Sewer Serv. Charge
	m^3/day	mgd	mg/l	mg/l	$/day
Wilson Packing Co.	4,920	1.3	1,200	1,400	115
Standard Rendering Co.	307	0.081	800	430	4
Owens-Corning Fiberglas Corporation					
Sunshine Rd. Effluent	1,305	0.345	1,120	1,300	35
Fiberglass Rd. Effluent	1,360	0.360	261	500	36

Owens-Corning Fiberglas Corp. was required to pay only $3.45 in surcharges per day to have 1,815 kg (4,000 lb) of suspended solids and 2,380 kg (5,240 lb) of BOD treated; Wilson Packing Co. paid about $43 in surcharges per day to treat 6,900 kg (15,200 lb) of suspended solids and 5,900 kg (13,000 lb) of BOD; Standard Rendering Co. would not be required to pay any surcharge on its waste. The Kaw Point WWTP received an average of 54,920 kg (121,080 lb) of suspended solids/day and 38,030 kg (83,840 lb) BOD/day. These three industries contributed a total of 20 percent* of the suspended solids and 33 percent* of the BOD, and only paid approximately $235/day in treatment fees (14 percent of treatment costs). Treatment costs are approximately $1,700/day (not including capital costs).

The new ordinance reflects more realistic costs of treatment. All three industries, previously mentioned, are in Class III. The approximate new sewer service charges and surcharges would be as follows:

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* Percent figures include percentages based on the calculated flow of 5,680 m^3/day (1.5 mgd) for Standard Rendering Co: using Standard Rendering Co. - reported flow of 307 m^3/day (0.081 mgd), the percentages are 16 percent suspended solids and 24 percent BOD.

	Sewer Service Fee (Flow only) $/day	Surcharge Fee[*] (Suspended Solids and COD) $/day
Wilson Packing Co.	260	1,100
Standard Rendering Co.[**]	16	37
Owens-Corning Fiberglas Corp.	141	536

The new surcharge and sewer service fees will make pretreatment of wastes and wastewater recirculation or conservation a necessity for industries.

Both ordinances prohibit the discharge of any waste containing "solids, greases, slurries or viscous material of such character or in such quantity that may cause an obstruction to the flow in the sewer or otherwise interfere with the proper functioning of the sewage works." Several industries were sampled to determine quantities of oil and grease discharged to the municipal system. These industries and the concentrations of oil and grease discharged [Appendix C: C-I: C-II; C-III: and C-IV] were:

	Oil and Grease (mg/1) Range
Wilson Packing Co.	1,000-2,300
Standard Rendering Co.	580-1,600
Chicago Rock Island RR	220-620
General American Transportation Corp.	350-1,100

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[*] These figures are based on COD because 2/3 of the COD concentration exceeds the BOD concentration.

[**] These figures are based on company flow of 307 m^3/day (0.081 mgd).

Well-mixed samples for analysis of oil and grease were collected at different times during the day. The city pump station and interceptor sewer serving Standard Rendering have been clogged with fats and greases, according to Standard Rendering Company officials. Because the ordinances do not specify concentrations, industries are allowed to discharge large amounts of oil and grease as long as sewers are not clogged. Kaw Point WWTP received an estimated 12,200 kg (26,900 lb) of oil and grease per day and, based on grab samples, removed only 5,190 kg/day (11,450 lb/day). Clearly, the ordinance was not being enforced.

Concentrations of toxic materials were not specified in the old ordinance. Owens-Corning Fiberglas Corp. discharged from 20 to 64 mg/l of phenols [Table C-6, Appendix C]. The Kaw Point WWTP discharged an average of 2 mg/l phenols to the river. Heavy metals in the Kaw Point influent either exceeded concentrations specified in the old ordinance or approached them [Tables B-1, B-2, and B-3, Appendix B]. Toxic materials may have been responsible for the failure of the sludge digesters to function properly [Appendix B: B-I, Subsection C].

The new ordinance limits the discharge of phenols and phenolic derivatives to 0.1 mg/l; chlorinated hydrocarbons to 0.05 mg/l; cyanides to 2.0 mg/l; and arsenic to 2.0 mg/l. Heavy metals are limited to the following: cadmium, 2 mg/l; chromium, 3 mg/l; copper, 5 mg/l; lead, 2 mg/l; zinc, 5 mg/l; nickel, 5 mg/l; and mercury, 0.3 mg/l. The allowable pH range has been changed from 5 to 10 to values of 6 to 9. All concentrations are specified for effluents discharged to the municipal sewer and not concentrations received at the treatment plant, as was the case for the old ordinance. Because of the new ordinance limitations the concentrations in the Kaw Point effluent probably will not meet the pretreatment requirements that are to be promulgated by the EPA.

Discharges to the Kansas River

Kansas City, Kansas, operates four wastewater treatment plants that discharge to the Kansas River. Three plants, No. 7, 8, and 20 are primary treatment facilities, and each has two sludge digesters which are not used. Sludge from the clarifiers is hauled to the Kaw Point WWTP for incineration.

At the time of the survey Plant No. 8 was operating efficiently, with BOD and suspended solids removals of 41 and 84 percent, respectively. However, the plant received wastes high in BOD and suspended solids (395 mg/l and 700 mg/l, respectively). Consequently, the effluent BOD concentration was 235 mg/l; suspended solids concentration was 110 mg/l [Table B-7, Appendix B]. Plants No. 7 and 20 removed 44 percent of the suspended solids: Plant No. 7 removed 26 percent of the incoming BOD and Plant No. 20 removed only 9 percent of the BOD [Tables B-8 and B-13, Appendix B].

The fourth plant, No. 9, is a secondary facility consisting of two separate systems treating the flows from two trunk sewers. Plant No. 9A is a trickling filter facility and Plant No. 9B consists of two 20,000-m^2 (5-acre) lagoons, operated in series. The first pond is aerated and receives the effluent from No. 9A; the effluent from the second pond discharges into Little Turkey Creek which flows into the Kansas River (RM 367.5/11.8).

Plant No. 9 achieved an overall BOD and suspended-solids reduction of 83 and 93 percent, respectively [Table B-8, Appendix B]. The effluent is not disinfected.

Salmonella bacteria were isolated from effluent samples of all four plants [Table VII-1] and in the Kansas River (RM 367.5/3.5) downstream from the outfalls [Table VI-1]. Fecal-coliform bacterial densities violated the Kansas criterion at all stations in the Kansas River.

Discharges to Turkey Creek

Three municipal wastewater treatment plants (Johnson County: Turkey Creek and Main plants, and Kansas City, Kansas Plant No. 5) discharge secondary treated domestic wastes to Turkey Creek between the Wyandotte-Johnson County line and the confluence with the Kansas River. The secondary effluent from Kansas City, Kansas, Plant No. 6 enters the creek approximately 2.1 km (1.3 miles) upstream of the county line.

The Johnson County plants were operating efficiently. The combined load discharged to the creek through the common outfall structure was 1,400 kg BOD/day (3,100 lb/day) and 1,040 kg suspended solids/day (2,300 lb /day). The effluent was disinfected: however *Salmonella* were isolated in the chlorine-contact basins.

Plants No. 5 and 6 had average BOD removals of 83 and 92 percent and suspended solids reductions of 84 and 85 percent, respectively. The daily waste load discharged by Plant No. 5 was 46 kg (102 lb) of BOD and 58.5 kg (129 lb) of suspended solids: Plant No. 6 discharged 59.5 kg (131 lb) of BOD and 79 kg (175 lb) of suspended solids. Neither effluent is disinfected. Fecal-coliform bacterial densities in Turkey Creek downstream from the discharges violated the Kansas Water Quality Standards. *Salmonella* were isolated in the effluents from all four plants [Table VII-1] and in the Kansas River (RM 367.5/1.1) downstream from the confluence with Turkey Creek (RM 367.5/3.4).

B. INDUSTRIAL WASTE SOURCES

Six industrial waste sources were evaluated; three of these discharged directly to the receiving waters and three to municipal sewers which subsequently discharged to the Kansas River without treatment.

Phillips Petroleum Company

This company [Appendix C: C-X] discharges all industrial and sanitary wastes directly to the Missouri River (RM 368.9). This wastewater is treated in three API oil separators, operated in parallel, followed by a clarifier and an air-flotation unit. Recovered oil is re-used, and solids are hauled to a landfill. A RAPP application has been filed for the wastewater outfall as well as a storm-water outfall (RM 369.5).

Except for phenols and oil and grease, the effluent met the EPA interim Effluent Guidelines for a Class-D refinery. The guidelines limit the discharge of phenols to 0.014 kg/100 m^3 (0.05 lb/1,000 bbl) per day and oil and grease to 1.4 kg/100 m^3 (5 lb/1,000 bbl) per day: Phillips discharge 0.11 kg phenols/100 m^3 (0.4 lb/1,000 bbl) and 1.8 kg oil and grease/100 m^3 (6.3 lb/1,000 bbl) per day.

Private Brands Incorporated--Gordon Corporation

PBI-Gordon [Appendix C: C-IX] formulates and packages "ready-to-use" chemicals and pesticides for private brand names. Numerous changes have been made in wastewater discharges: wash water is held in 208-liter (55-gal.) drums and re-used: floor drains have been plugged, products are formulated in batches and proceed from minimum-to-maximum concentrations, and sanitary wastes, as of October 1972, are discharged to the municipal sewer. Wastewater (approx. 4.5-7.6 m^3/day or 1,200-2,000 gpd) was discharged directly to the Kansas River (RM 367.5/1.2); a RAPP application has been filed for this discharge.

Although the effluent supposedly contained only cooling water, boiler water, and sanitary wastes, concentrations of 2,4-D Methyl Ester (36-300 μg/l), 2,3-dichlorophenol (40-2,000 μg/l), Banvel-D Methyl Ester (10-51 μg/l), and p-chlorophenol (180-35,000 μg/l) in the effluent indicate that all process waste discharges have not been eliminated. Although there were no stream data collected immediately downstream from the discharge to illustrate the effects of the waste, degradation of water quality could occur in a localized section of the river.

Penn Central Company, Inc.

The company [Appendix C: C-XI] packages, and occasionally mixes, 946 m^3/week (250,000 gal./we~k) of oils and chemicals for large oil corporations. Storm and boiler water are discharged to Turkey Creek (RM 367.5/3.4/2.4) from a storm sewer on company property. Oils and chemicals, spilled on the grounds, flow into this storm sewer and into Turkey Creek. A RAPP program application has not been filed.

The effluent concentrations were: 360 mg/l of BOD, 555 mg/l of COD, 126 mg/l of suspended solids, 410 mg/l of oil and grease, and fecal coliform densities of 420/100 ml. The flow (est. at 0.06 l/s or 1 gpm) was intermittent. Control of this waste discharge could be readily accomplished by preventing oil and chemical spills on the plant grounds.

Colgate-Palmolive Company

Colgate-Palmolive [Appendix C: C-VI] produces varied amounts of soap, detergents, cosmetics, and other toilet preparations. All wastewater is discharged either to the Kansas Avenue or Osage Street municipal sewer. The Osage Street sewer flows into the Kansas River (RM 367.5/5.5) approximately 0.8 kilometer (0.5 mile) down-sewer of the Colgate-Palmolive discharge. Characteristics of the waste [Table C-7, Appendix C] indicate that process and sanitary wastes were being discharged.

Effects of the Colgate-Palmolive discharge in the Kansas River were not evident as the Osage Street sewer carries a large volume of domestic wastewater. The waste discharged by the company is amenable to treatment and should be intercepted by the City.

Sims Barrel Company

The Sims Barrel Company [Appendix C: C-VII] reclaims, cleans, and paints approximately 1,500 two-hundred-eight-liter (55 gal.) barrels per day. The barrels contain residues from chemicals, paints, and petroleum products. Industrial waste is treated before discharge to the 12th Street sewer which flows into the Kansas River (RM 367.5/4.4). The City plans to intercept the 12th Street sewer discharge in late 1973.

The effluent had large concentrations of BOD (1,400 mg/l), COD (2,800 mg/l), oil and grease (180 mg/l), and phenols (9.8 mg/l). Heavy metals and organic compounds [Tables C-10 and C-11, Appendix C] were found in the effluent. The pH of the effluent ranged from 7.2 to 11.2, thus violating City Ordinances No. 42913 and No. 51421 [Appendices I and O]. The outfall of the 12th Street sewer had BOD, COD, oil and grease, phenols, and metal concentrations [Table C-10] much greater than domestic waste, indicating that the Sims Barrel effluent contributed a significant portion of the pollutants discharged to the Kansas River. Organic compounds in the Sims Barrel waste could cause localized degradation of water quality in the Kansas River downstream from the 12th Street sewer outfall. Pretreatment is required to reduce the previously named parameters to acceptable levels.

Acme Plating Corporation

This custom plating firm [Appendix C: C-VIII] has the facilities to perform various types of metal finishing. Industrial wastewater of approximately 242 m^3/day (0.064 mgd) is discharged to the Argentine storm sewer which flows into the Kansas River (RM 367.5/5.1). The firm was issued a permit, by the Office of the City Engineer, to discharge into the sewer because no other sewers were available. The City plans to connect the Argentine storm sewer in 1974 to the Kaw Point WWTP. A RAPP application has been filed.

Heavy metals detected in the effluent included: lead (0.28 mg/l), zinc (4.4 mg/l), copper (1.03 mg/l), chromium (2.7 mg/l), cadmium (0.45 mg/l), nickel (2.8 mg/l), and mercury (1.5 µg/l). These average concentrations are greater than the limits in the EPA interim Effluent Guideline for the metal finishing industry. In addition, the effluent contained an average of 9.4 mg/l cyanide and had a pH as low as 2.8: both were violations of City Ordinances No. 42913 and No. 51421 and created hazardous conditions in the plant and storm sewer (i.e., HCN gas is released). Treatment is required to reduce the cyanide discharged and neutralize the pH. Heavy-metal concentrations are within the limits specified by the new City Ordinance No. 51421, but will not meet the Pretreatment Standards to be promulgated under the 1972 Amendments of the FWPCAA.

C. DIRECT DISCHARGES OF UNTREATED DOMESTIC AND INDUSTRIAL WASTES

Sewer outfalls discharging to the Kansas River (RM 367.5/10 to 367.5/0), Turkey Creek (RM 367.5/3.4/3.8 to 367.5/3.4/0.0), and South Jersey Creek (RM 369/4.1 to 369/0.0) were located in May and June of 1972. [Locations of outfalls and waste characteristics are listed in Appendix D.] The majority of the outfalls were storm sewers; however, untreated wastes were being discharged directly to the three receiving streams.

Kansas River

Sixty-six sewer outfalls were located in the lower 16 km (ten miles) of the river. Of these, 17 outfalls discharged untreated industrial or domestic wastes. The outfalls that contributed most of the pollutants were the 34th Street sewer (RM 367.5/6.6), Osage Street sewer (RM 367.5/5.5), Argentine sewer (RM 367.5/5.1), and 12th Street sewer (RM 367.5/4.4). The Turkey Creek outflow (RM 367.5/3.4) discharged significant amounts of pollutants to the river.

The flow from the 34th Street sewer (estimated to be 11,350 m^3/day or 3 mgd) contained untreated domestic wastes. The fecal-coliform bacterial were 1,300,000/100 ml.

The Osage Street sewer contained untreated domestic and industrial (Colgate-Palmolive) wastes. The measured flow was 34,060 m^3/day (9 mgd). The fecal-coliform bacterial densities ranged from 19,000 to 370,000/100 ml.

Untreated industrial wastes from the Acme Plating Company, treated industrial wastes from the Santa Fe Railroad Yards, and untreated domestic wastes were discharged from the Argentine sewer. The flow was estimated to be 7,570 m^3/day (2 mgd). Fecal coliforms were low, log mean of 490/100 ml, but cyanide (1.3 mg/l) and heavy-metal concentrations were high [Table C-12, Appendix C].

Effluent from the 12th Street sewer outfall was characterized by a BOD of 1,650 mg/l, COD of 2,380 mg/l, and a log mean fecal coliform density of 1,400,000/100 ml. Heavy metals, phenols [Table C-10, Appendix C], and organic compounds [Table C-11] from the Sims Barrel Company were also discharged. The flow was estimated to range from 11,300 to 18,900 m^3/day (3 to 5 mgd). The estimated waste loads discharged are as follows:

	BOD		Suspended Solids	
Sewer	(kg/day)	(lb/day)	(kg/day)	(lb/day)
34th St.*	590	1,300	5,400	12,000
Osage St.	500	1,100	7,480	16,500
Argentine	320	700	160	350
12th St.	24,900	55,000	2,860	6,300

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* This is based on one grab sample.

Turkey Creek

This tributary to the Kansas River drains a predominantly urban and suburban watershed of 62 km^2 (24 square miles). The creek is degraded by urban runoff, discharges of industrial and treated domestic wastes, and intermittent by-passes and direct discharges of untreated domestic wastes. Turkey Creek constitutes a significant source of pollution to the Kansas River.

Thirty-six outfalls were located in the 6.1 km (3.8-mile) reach. Discharges from ten of these contained either domestic and/or industrial wastes.

One major waste source is the Turkey Creek Interceptor Stub [Tables D-3 and D-4, Key No. T-2, Appendix D]. The flow was estimated to be 7,570 m^3/day (2 mgd), and the characteristics were similar to domestic waste. This outfall discharged 1,040 kg (2,300 lb) of BOD and 1,540 kg (3,400 lb) of suspended solids to the creek. The waste originally was to be transported across the state line for treatment by a Kansas City, Missouri, WWTP. However, completion has been delayed, since 1964, for lack of an agreement between the two municipalities. The Kansas State Board of Health required that the City of Kansas City, Kansas, develop a plan of action regarding this sewer before January 1, 1972, and to include a commitment for the facility to be operational no later than December 31, 1975. The City has applied for an EPA construction grant to connect this discharge to the Kaw Point WWTP by December 31, 1975.

A second major waste source is a 2.4-m (8-ft) horseshoe sewer [Appendix D, Tables D-3 and D-4, Key No. T-5] that discharged approximately 11,300 m^3/day (3 mgd). This sewer runs underneath the Frisco Railroad yards. The chemical analyses disclosed that the discharge contained domestic waste. The outfall discharged about 540 kg (1,200 lb) of BOD and 520 kg (1,150 lb) of suspended solids to the creek. The fecal-coliform bacterial density was 1,400,000/100 ml.

The log mean bacterial densities in Turkey Creek 0.2 km (0.1 mile) upstream of its confluence with the Kansas River were: total coliforms, 3,800,000/100 ml; fecal coliforms, 210,000/100 ml; and fecal streptococci, 64,000/100 ml [Appendix P, Table P-2]. *Salmonella* [Table VII-1] were isolated in the effluent from each of the wastewater treatment plants discharging to the creeks. The large bacterial concentrations, a violation of the Kansas water quality bacteriological criteria, constituted a health hazard in Turkey Creek and the Kansas River.

Jersey Creek

The Jersey Creek watershed includes one of the most densely populated areas in Kansas City, Kansas. Land use is predominately residential and commercial. North Jersey Creek originates at Kimbal Avenue, west of 32nd Street, and joins South Jersey Creek at 18th Street and Chelsea Trafficway. South Jersey Creek originates at 38th Street between Everett and Oakland Avenues. The creek provides the only natural outlet to the Missouri River for wastes generated by the adjacent community. Combined and interceptor sewers discharge untreated wastewaters directly to the creek.

In January 1969 the City of Kansas City, Kansas, retained the consulting engineering firm of Taliaferro and Browne to develop plans and recommendations for improvements to the Jersey Creek area.[15/] A two-stage approach was proposed. The long-range proposal was to provide separate storm and sanitary sewer systems in the Jersey Creek watershed. A short-range or interim proposal was to eliminate all domestic waste entering the creek, except during periods of intense or extended storms. The wet-weather overflow would be diverted to the creek. Channel improvements and realignment plus use of the land adjacent to the creek for parks and recreational purposes were also proposed to improve environmental conditions.

The Jersey Creek Project was divided into five phases for the construction of channel improvements, interceptor sewers, and related sewer separation facilities:

Phase I - Between 4th and 11th Streets:
Phase II - Between 11th and 18th Streets;
Phase III - On North Jersey Creek between 18th and 34th Streets:
Phase IV - On South Jersey Creek between 18th and 38th Streets.

Phase V called for the construction of sewer separation facilities throughout the Jersey Creek watershed.

In November 1968 the citizens passed a bond issue that included five million dollars for improvements to the Jersey Creek area. In addition, Federal funds under the Water and Sewer Facilities Grant Program of the Department of Housing and Urban Development were secured. All funds have been committed, and only Phase I has been completed.

Phases II and III are either partially complete or are in the construction stage.

Sixteen storm sewers (of which, two transport sanitary wastes) and seven sanitary outfalls were located in South Jersey Creek. from 13th Street to its source [Tables D-4 and D-5, Appendix D]. (Wastes discharged to North Jersey Creek have been intercepted.) The sanitary outfalls have not been eliminated as yet. Conditions along the creek in the reach from 22nd Street to 11th Street were characterized by stagnant, septic pools, scattered trash and debris, and rat-infested areas. The creek is a blight in the community and a menace to health. The improvement of the area must be continued in order to eliminate the pollution and potential health hazards.

A brief description of raw-waste discharges are as follows [See Table D-5, Appendix D, for location]:

121.9-cm (48 in.) dia. pipe - this pipe serves as an overflow for the Kensington Sanitary Interceptor Sewer [Key No. J-14]:

10.2-cm (4 in.) dia. clay pipe - kitchen wastes (spaghetti, soap suds, garbage) that accumulated at the outfall, apparently came from the residential area. The flow was a small trickle [Key No. J-15]:

10.2-cm (4 in.) dia. pipe - sanitary waste solids, apparently from a residential area, had accumulated at the outfall. No flow was observed [Key No. J-16]:

38.1-cm (15 in.) dia. concrete pipe - waste flow was from the overflow manhole on a sanitary intercepting sewer under Glendale Avenue [Key No. J-17]:

10.2-cm (4 in.) dia. clay pipe - the source of black sludge that had accumulated at the outfall is apparently a septic tank. The flow was small and the wastewater had a septic odor [Key No. J-18]:

Hidden pipe (behind rocks) of unknown size - located behind APCO service station at 18th Street and Troup Street. Rats were observed in the area [Key No. J-19]:

15.2-cm (6 in.) dia. cast iron pipe - flow was small and it was not possible to determine the type of waste discharged [Key No. J-20];

10.2-cm (4 in.) dia. clay pipe - sanitary waste solids had accumulated at the outfall. Large colonies of bloodworms were observed in the creek downstream from this outfall. This sewer evidentally serves the residential area. The flow was a small trickle [Key No. J-21]: and

45.7-cm (18 in.) dia. clay pipe - the source of this discharge was the overflow from a manhole, about 6.1 m (20 ft.) up the bank. The invert of the pipe was at ground level (i.e., pipe was exposed and not adequately protected), and the pipe was broken at both the manhole inlet and outlet. The flow, estimated at 3785 m^3/day (1 mgd), was discharging from the pipes outside of the manhole [Key No. J-24].

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REFERENCES

1. *Pollution of Interstate Waters, Missouri River, Kansas City Metropolitan Area*, Transcript of Conference. December 3, 1957.

2. *Pollution of Interstate Waters, Missouri River and Connecting or Tributary Waters In or Adjacent to the Kansas City Metropolitan Area*, Transcript of Hearing, U. S. Department of Health, Education and Welfare, Public Health Service. Kansas City, Missouri. June 13-17, 1960

3. *Progress Evaluation Meeting in the Matter of Pollution of the Interstate Waters of the Missouri River and Tributary Waters Kansas City Metropolitan Area*, Transcript of Proceedings, U. S. Department of Health, Education, and Welfare, Public Health Service. Kansas City, Missouri. April 21, 1965.

4. *Reconnaissance Survey of the Lower Kansas River, Kansas*, Environmental Protection Agency, Water Quality Office, Division of Field Investigations-Denver Center, Denver, Colorado, and Missouri Basin Region, Kansas City, Missouri. March 1971.

5. *"Water Resources for the Kansas City Area, Missouri and Kansas"* Geological Survey Circular 273, United States Geological Survey, Department of the Interior. Washington, D.C. 1953.

6. *"Surface Water Records,"* Water Resources Date for Kansas. United States Geological Survey, United States Department of the Interior, 1969. Washington, D.C.

7. *"1970 Population Census, U. S."* Census Bureau, United States Department of Commerce. Washington, D.C. 1970.

8. D. G. Ballinger and G. D. McKee *Chemical Characterization of Bottom Sediments*. Jour. Water Poll. Control Fed. Vol. 43 No. 2 pp 216-227. 1971.

9. Ross E. Powers, *Biological Survey of the Kansas River Basin.* U. S. Department of the Interior, Federal Water Pollution Control Administration, Missouri Basin Region. Kansas City, Missouri. 22 pp (Mimeo). 1966.

10. Dean Shumway and John R. Palensky. *Impairment of the Flavor of Fish by Water Pollutants.* Department of Fisheries and Wildlife, Oregon State University for the Office of Research and Monitoring, EPA, Grant No. 18050DDM, 80 pp. 1972.

REFERENCES (Cont.)

11. Anon, Quarterly Research Report-National Water Quality Laboratory. EPA Duluth, Minnesota, December 31, 1971 (Mimeo).

12. J. E. McKee and H. W. Wolf. *Water Quality Criteria, 2nd ed.*, State Water Quality Control Board of California. Publ. No. 3-A. 1963.

13. J. H. Hubschman *Effects of Copper on the Crayfish Orconectes rusticus (Gerard)* I. Acute toxicity. Crustaceana 12(1) 33-41.

14. Harold E. Babbitt, and E. Robert Baumann, *Sewerage and Sewage Treatment*, John Wiley and Sons. New York, N.Y. 1958.

15. *Engineering Report Jersey Creek Improvement Kansas City, Kansas*, Taliaferro and Browne Consulting Engineers, P. A. Kansas City, Kansas. September 1970.

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WATER QUALITY STANDARDS (EXCERPTS) FOR KANSAS

KANSAS RIVER, KANSAS

All municipal wastes discharged within the Kansas river basin shall receive a minimum of secondary treatment to achieve a minimum of 85 percent reduction of the five-day biochemical oxygen demand by December 31, 1975. All industrial wastes discharged within the Kansas river basin will receive an equivalent treatment by December 31, 1975. The objective of treatment or control will be to reduce the organic load, oil, grease, solids, alkali, acids, toxic materials, color and turbidity, taste and odor products and other deleterious materials to the lowest practicable level.

Continuous disinfection of treated wastes shall be provided for those municipalities and industries which contribute bacterial loadings to a river or stream used as a downstream public water supply and which supplies are within the zone of bacterial influence.

Seasonal disinfection (April 1 through October 31) of treated wastes shall be provided for those municipalities or industries which contribute bacterial loadings to rivers or streams which are tributary to waters used for body contact recreation and such waters are within the zone of bacterial influence.

(1) Kansas River - Main stem. (A) Water uses. The Kansas river is used for public water supply, industrial water supply, recreation including sport fishing, agricultural purposes, and receipt of treated wastes.

(B) General criteria. The cumulative effect of waste discharges to the Kansas river will be guided by the 1962 U. S. public health service drinking water standards except that for substances toxic to fish, standards generally accepted for fishery environment will be considered. Pollutional substances will be maintained below maximum permissible concentrations which would be detrimental for public water supplies, recreation requirements, agricultural needs, industrial needs, and other established beneficial use.

(C) Specific criteria. (1) Bacteria: (a)(1) In waters designated for public water supply, the fecal coliform content shall not exceed 2,000 per 100 ml sample.

(b)(1) In waters designated for body contact recreation, the fecal coliform content based on a minimum of not less than five samples taken over not more than a 30-day period, shall not exceed a log mean of 200 per 100 ml sample, nor shall more than 10 percent of total samples during any 30-day period exceed 400 per 100 ml sample.

(c)(1) In waters designated for recreation including sport fishing, the fecal coliform content shall not exceed 2000 per 100 ml sample.

(2) Dissolved oxygen: The dissolved oxygen of the river shall be maintained at or above 5 mg/l. Dissolved oxygen concentrations less than 5 mg/l shall not be due to man-made waste discharges.

(3) Temperature:(2) Waste discharges shall not elevate the temperature of the river above 90°F. Heat of artificial origin shall not be added to a stream in excess of the amount that will raise the temperature of the water more than 5°F above natural conditions. The epilimnion of lakes shall not be raised more than 3°F above that temperature which existed before the addition of heat of artificial origin. The normal daily and seasonal temperature variations before the addition of heat due to other than natural cases should be maintained. The measurement system to be used in each case should provide for temperature measurements at the outfall and with the maximum temperature allowed at the outfall reflecting a reasonable mixing zone in the receiving waters so that the 5°F or 3°F rise specified is not violated in the contiguous receiving waters. Any barrier to migration and and the free movement of the aquatic biota is prohibited.

(4) Hydrogen ion potential: Waste discharge shall not cause the pH of the river to vary below 6.5 nor above 8.5.

(5) Oil and grease: The river shall be essentially free of visible oil and grease. Dissolved or emulsified grease concentrations shall be kept below levels which will interfere with established beneficial use.

(6) Solids: There shall be no man-made deposits of solids in the river, either organic or inorganic, which will be detrimental to established beneficial use.

The river shall be free of floating debris, scum, and other floating materials attributable to municipal, industrial, and other waste disposal practices in amounts sufficient to be unsightly or detrimental to established beneficial use.

(7) Turbidity: There shall be no turbidity increase, of other than natural origin, that will cause substantial visible contrast with the natural appearance of the river or be detrimental to established beneficial use.

(8) Taste and odor producing substances: Taste and odor producing substances from man-made sources shall be limited to concentrations in the river that will not interfere with the production of potable water by reasonable water treatment processes or impart unpalatable flavor to fish, or result in noticeable offensive odors in the vicinity of the water, or otherwise interfere with established beneficial use of the river.

(9) Color: Man-made discharges of color producing substances shall be limited to concentrations which will not be detrimental to established beneficial use.

(d) Tributaries to the Kansas river. All waste discharges to tributaries of the Kansas river shall be controlled so that the quality of water will not be reduced beyond the limits of established criteria. In intermittent stream waters, the fecal coliform shall not exceed 4,000 per 100 ml sample.(1) Tributaries shall additionally be controlled so that public health hazards of nuisance conditions will not develop within tributary streams or drainage courses.

MISSOURI RIVER, KANSAS

All municipal waste discharged within the Missouri river basin shall receive a minimum of secondary treatment to achieve a minimum of 85 percent reduction of the five-day biochemical oxygen demand by December 31, 1975. All industrial wastes discharged within the Missouri river basin will receive an equivalent treatment by December 31, 1975. The objective of treatment or control will be to reduce the organic load, oil, grease, solids, alkali, acids, toxic materials, color and turbidity, taste and odor products and other deleterious materials to the lowest practicable level.

Continuous disinfection of treated wastes shall be provided for those municipalities and industries which contribute bacterial loadings to a river or stream used as a downstream public water supply and which supplies are within the zone of bacterial influence.

Seasonal disinfection (April 1 through October 31) of treated wastes shall be provided for those municipalities or industries which contribute bacterial loadings to rivers or streams which are tributary to waters used for body contact recreation and such waters are within the zone of bacterial influence.

(1) Missouri River - Main stem. (A) Water uses. The Missouri river in Kansas is used for public water supply, industrial water supply, recreation including sport fishing, agricultural purposes, commercial fishing, and receipt of treated wastes.

(B) General criteria. The cumulative effect of waste discharges to the Missouri river will be guided by the 1962 U. S. Public Health Service Drinking Water Standards except that for substances toxic to fish, standards generally accepted for fishery environment will be considered. Pollutional substances will be maintained below maximum permissible concentrations which would be detrimental for public water supplies, recreation requirements, agricultural needs, industrial needs, and other established beneficial use.

(C) Specific criteria. (1) Bacteria: (a)(1) In waters designated for public water supply, the fecal coliform content shall not exceed 2,000 per 100 ml sample.

(b)(1) In waters designated for body contact recreation, the fecal coliform content based on a minimum of not less than five samples taken over not more than a 30-day period, shall not exceed a log mean of 200 per 100 ml sample nor shall more than 10 percent of total samples during any 30-day period exceed 400 per 100 ml sample.

(c)(1) In waters designated for recreation including sport fishing, the fecal coliform content shall not exceed 2,000 per 100 ml sample.

(2) Dissolved oxygen: The dissolved oxygen of the river shall be maintained at or above 5 mg/l. Dissolved oxygen concentrations less than 5 mg/l shall not be due to man-made waste discharges.

(3) Temperature:(2) Waste discharges shall not elevate the temperature of the river above 90°F. Heat of artificial origin shall not be added to a stream in excess of the amount that will raise the temperature of the water more than 5°F above natural conditions. The epilimnion of lakes shall not be raised more than 3°F above that temperature which existed before the addition of heat of artificial origin. The normal daily and seasonal temperature variations before the addition of heat due to other than natural causes should be maintained. The measurement system to be used in each case should provide for temperature measurements at the outfall and with the maximum temperature allowed at the outfall reflecting a reasonable mixing zone in the receiving waters so that the 5°F or 3°F rise specified is not violated in the contiguous receiving waters. Any barrier to migration and the free movement of the aquatic biota is prohibited.

(4) Hydrogen ion potential: Waste discharge shall not cause the pH of the river to vary below 6.5 nor above 8.5.

(5) Oil and grease: The river shall be essentially free of visible oil and grease. Dissolved or emulsified grease concentrations shall be kept below levels which will interfere with established beneficial use.

(6) Solids: There shall be no man-made deposits of solids in the river, either organic or inorganic, which will be detrimental to established beneficial use.

(7) Turbidity: There shall be no turbidity increase, of other than natural origin, that will cause substantial visible contrast with the natural appearance of the river or be detrimental to established beneficial use.

(8) Taste and odor producing substances: Taste and odor producing substances from man-made sources shall be limited to concentrations in the river that will not interfere with the production of potable water by reasonable water treatment processes or impart unpalatable flavor to fish, or result in noticeable offensive odors in the vicinity of the water, or otherwise interfere with established beneficial use of the river.

(9) Color: Man-made discharges of color producing substances shall be limited to concentrations which will not be detrimental to established beneficial use.

(d) **Tributaries in the Missouri River.** All waste discharges to tributaries of the Missouri river shall be controlled so that the quality of the water will not be reduced beyond the limits of established criteria. In intermittent stream waters the fecal coliform shall not exceed 4,000 per 100 ml sample(1). Tributaries shall additionally be controlled so that public health hazards or nuisance conditions will not develop within tributary streams or drainage courses.

WATER QUALITY STANDARDS (EXCERPTS) FOR MISSOURI

MISSOURI RIVER, MISSOURI

General Criteria

1. All tributary streams and all municipal, industrial, agricultural, and mining effluents shall not create conditions in the stream which will adversely affect the present water uses or the future water uses as they become current.

2. Minimum water quality conditions applicable to all waters of the State including: 1) low flow streams which are defined as any stream with a flow of 0.1 cfs or less for an average of seven consecutive days which average flow is expected to recur once every two years or less; 2) any streams for which an exception to the water quality criteria has been granted due to low flow conditions or other reasons; and 3) any other streams for which criteria have not been specifically established.

   a. Substances attributable to municipal, industrial, agricultural, mining, or other effluents shall not cause the formation of putrescent or otherwise objectionable sludge deposits on the stream bed.

   b. The stream shall be free from floating debris, oil, scum, and other floating materials attributable to municipal, industrial, agricultural, mining or other effluents in amounts sufficient to be unsightly or deleterious.

   c. The stream shall be free from materials attributable to municipal, industrial, agricultural, mining or other effluents producing color, odor or other conditions in such degree as to create a nuisance.

   d. Substances attributable to municipal, industrial, agricultural, mining or other effluents shall not have a harmful effect on human or animal life.

3. The Missouri Water Pollution Board will require all necessary and reasonable measures to prevent the water quality of all waters of the State for being less than these minimum standards.

Specific Criteria

1. Flow - Water quality standards shall be met at all times regardless of the flow unless an exception is granted by the Missouri Water Pollution Board. For flow information, the U.S. Army Corps of Engineers and U. S. Geological Survey should be consulted.

2. Stream Sampling - Sampling points for interstate streams shall be determined by the Missouri River Pollution Board and the State Water Pollution Control Agencies of contiguous states. Sampling points for all other streams shall be determined by the Missouri Water Pollution Board.

3. Methods of Sampling, Preservation and Analyses - The methods of sample collection, preservation, analyses, and measurements to determine water quality and the accuracy of results shall be in accordance with the Twelfth Edition of Standard Methods for the Examination of Water and Wastewater, published jointly by the American Public Health Association, American Water Works Association and the Water Pollution Control Federation, or in the case of interstate streams, other methods mutually agreed upon by the Missouri Water Pollution Board and the State Water Pollution Control Agencies of contiguous states.

Water Quality Criteria

1. Missouri River

   a. pH

      The pH shall be between 6.5 and 9.0 in the stream. A pH above 9.0 in the stream shall not be due to effluents or surface runoff.

   b. Dissolved Oxygen concentration shall be maintained at a minimum 5.0 mg/l or greater. It is recognized that this standard is violated at frequent intervals for periods of 2 to 3 weeks during rising river stages or flooding in the basin. The specific sources which cause such depressions include major contributions from surface runoff (urban areas, farms, and associated activities) which have not been clearly identified. We recognize the need for a coordinated effort on the part of the tributary States and Federal Government to inventory these waste sources so that implementation plans can be developed to remedy the dissolved oxygen deficiency.

   c. Temperature

      Effluents shall not elevate or depress the average cross sectional temperature of the stream more than 5°F. The stream temperature shall not exceed 90°F due to effluents.

d. Substances Potentially Toxic or Detrimental

Substances toxic to humans, fish and wildlife or detrimental to agricultural, mining, industrial, recreational, navigational, or other legitimate uses shall be limited to non-toxic or non-detrimental concentrations in the stream.

e. Bacteria*

The fecal coliform, in waters designated for drinking water supply, boating and canoeing, and/or fishing, shall not exceed 2,000/100 ml. (either MPN or MF count) except in specified mixing zones adjacent to or downstream from waste outfalls. The above criteria shall not be applicable when the stream is affected by storm water runoff.

f. Taste and Odor Producing Substances

Taste and odor producing substances discharged shall be limited to concentrations in the stream that will not interfere with the production of potable water by reasonable water treatment processes, or impart unpalatable flavor to food fish, or result in noticeable offensive odors in the vicinity of the water, or otherwise interfere with the reasonable use of the water.

g. Color

There shall be no color or other than natural origin that will cause substancial visible contrast with the natural appearance of the stream or interfere with its legitimate uses.

h. Oil and Grease

The stream shall be virtually free of oil and grease. Emulsified oil and grease concentrations shall be kept below levels which will interfere with beneficial uses of the stream.

i. Solids

There shall be no noticeable man-made deposits of organic solids on the stream bed. The stream shall be free of floating debris, scum, and other floating materials attributable to municipal, industrial and other waste disposal practices in amounts sufficient to be unsightly or deleterious.

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* These criteria are the objectives which will be used until studies and monitoring can be completed by December 31, 1979.

j. Radioactive Materials

The dissolved radium 226 and strontium 90 shall not exceed 3 and 10 picocuries/liter (pc/l), respectively, in the stream due to effluents or surface runoff. In the absence of strontium 90 and alpha emitters, the gross beta concentration shall not exceed 1,000 pc/l in the stream due to effluents or surface runoff.

k. Fluorides

The soluble fluoride concentration in the stream shall not exceed 1.2 mg/l due to effluents or surface runoff.

MUNICIPAL WASTE SOURCES

This appendix summarizes information on those municipal waste sources investigated in the Kansas City, Kansas, metropolitan area, September 14 to October 5, 1972. Ten municipal plants were evaluated in order to determine both the adequacy of present treatment practices and the waste loads being discharged. Seven of the plants are located in Kansas City, Kansas; two in Johnson County, Kansas; and one in Kansas City, Missouri. Permission for EPA personnel to sample the influent and effluent and to make flow measurements was requested [Appendix F]. All plant officials were cooperative and granted permission to sample on their premises. The Chain-of-Custody Procedure was followed for each sample [Appendix E].

The following format was used in preparation of the individual evaluation reports:

A. General -- includes background information and contacts;

B. Waste-Treatment Facilities -- includes type of system, number and sizes (where information was available) of units, and a flow diagram;

C. Operations -- includes plant maintenance and operational procedures and difficulties;

D. Treatment Plant Evaluation and Findings -- includes information on evaluation procedure, data from chemical and bacteriological analyses, and observations;

E. Summary and Conclusions;

F. Recommendations -- waste treatment requirements recommended were based on the following factors:

1. Compliance with applicable water quality standards
2. Waste load limits consistent with those established by the Federal Water Pollution Control Act Amendments of 1972.

B-I. KAW POINT WASTEWATER TREATMENT PLANT
KANSAS CITY, KANSAS

A. GENERAL

The Kaw Point WWTP, located in the Woodswether Industrial District [Figure 1.], became operational in 1968. This primary treatment plant receives domestic and industrial waste from the Armourdale, Central Industrial District and Fairfax pumping stations. A staff of 46 people, including nine state certified operators, are employed to maintain and operate the plant 7 days/week, 24 hr/day.

The effluent flows into the Missouri River, via a submerged outfall (RM 367.25), immediately upstream of the Kansas-Missouri state line. The effluent is not disinfected.

The plant serves a population of 40,000 to 50,000. Approximately 60 percent of the flow and 80 percent of the BOD and suspended solids originates from industrial sources. Major industries that discharge to the Kaw Point plant include:

Proctor and Gamble (detergent manufacturing)
Colgate-Palmolive (detergent manufacturing)
Wilson and Company (slaughtering & processing)
National Beef Company (beef processing)
Sambol Packing (slaughtering)
Standard Rendering Company
Thompson-Hayward Chemical Company (organic chemicals, pesticides)
Chicago Rock Island Railroad
Safeway Stores (dairy operations, shipping and receiving
  facilities)
Buick-Oldsmobile-Pontiac (automobile assembly)
Owens-Corning Fiberglas Corporation
Certain Teed-St. Gobain Company (fiber glass)
Mobil Oil
Sinclair Petroleum
Westvaco Corporation (chemicals)

Personnel from the EPA conducted an in-plant evaluation from September 22-28, 1972. Robert B. Cooke, director, and Myron L. Cailteux, manager, Water Pollution Control Department, Kansas City, Kansas, provided assistance and information on the Kaw Point plant and the six district wastewater treatment plants under their management.

B. WASTE TREATMENT FACILITIES

The hydraulic design capacities are as follows: maximum dry- and wet-weather flow, 492,000 m^3/day (130 mgd); average daily flow, 132,500 m^3/day (35 mgd); and peak daily flow, 193,000 m^3/day (51 mgd). A list of the principal plant components [Figure B-1] and a brief description of each follows.

1. Preliminary treatment -- mechanically cleaned bar screens followed by four enclosed pre-aeration basins (each 3.7 m or 12 ft wide x 5.2 m or 17 ft deep x 27.4 m or 90 ft long) equipped for grit collection and removal,
2. Primary treatment -- four clarifiers (each 32 m or 105 ft square by 2.4 m or 8 ft deep) with sludge-removal systems. The overflow from the clarifiers discharges to the Missouri River through a submerged outfall. Disinfection is not practiced.
3. Digestion -- six anaerobic digesters, each with a capacity of 2,180 m^3 (577,000 gal.) and (12.2 m or 40 ft dia., 18.3 m or 60 ft deep). Two of the digesters are heated and sludge recirculation provided. Gas from the digesters can be used for heating and incineration fuel. Methane can be stored in a gas storage tank.

B.4.A

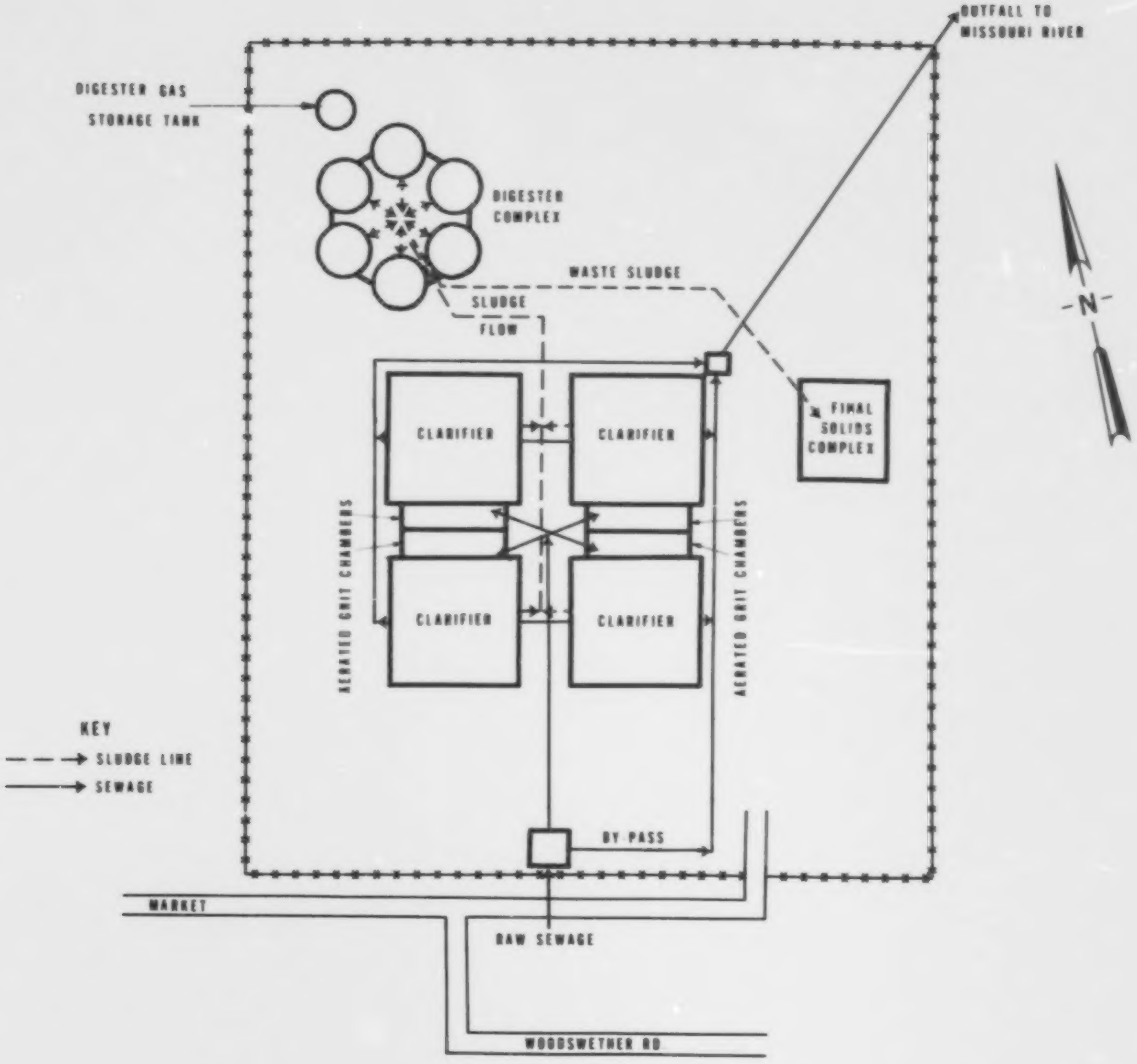
OUTFALL TO MISSOURI RIVER
DIGESTER GAS STORAGE TANK
DIGESTER COMPLEX
WASTE SLUDGE
SLUDGE FLOW
N
CLARIFIER
CLARIFIER
FINAL SOLIDS COMPLEX
AERATED GRIT CHAMBERS
AERATED GRIT CHAMBERS
CLARIFIER
CLARIFIER
KEY
SLUDGE LINE
SEWAGE
BY PASS
MARKET
RAW SEWAGE
WOODSWETHER RD.

Figure B-1. Kansas City, Kansas Kaw Point Wastewater Treatment Plant

4. Incineration -- sludge and grease removed from the clarifiers and the digesters are dewatered in 12 Mercobowl centrifuges, rated at 270 kg (600 lb) dry solids/hr and operating in parallel, and burned in two 4.3 m (14-ft) diameter, Dorr-Oliver FLUOSOLIDS Reactor incinerators rated at 49,900 kg (110,000 lb) dry solids/day. The incinerators are operated approximately 16 hr/day, 5 days/week. Stack gases pass through a venturi scrubber followed by an impingement plate capable of reducing the particulate concentration to 0.02 grains/standard cu ft.* Fly ash is drained to a holding pond and the concentrate from the centrifuges is returned to the head of the plant.
5. By-pass methods -- one is to discontinue pumping and allow all the flow to go to the river. The second method is to continue to pump and allow the excess flow to go to the river. By-passing occurs when the wet-weather flow is greater than three times the dry-weather flow of 132,500 m^3/day (35 mgd).
6. Flow measurement -- because flow-measuring equipment is inoperative, the approximate flow was determined from lift-station pump-rating curves and the duration of pumping.

C. OPERATIONAL DIFFICULTIES

The plant uses only three clarifiers at one time. The use of four clarifiers increases the detention time so that the wastewater becomes septic. When a clarifier is not on line, it is cleaned, all iron work is checked for deterioration, and corner sweep arms are checked and lubricated for freedom of movement. Each clarifier is cleaned once a year.

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* This value would be slightly different in metric units since the cubic meter is standardized at 760 mm of mercury at 0°C and varies with the type of gas.

The digester facilities are inoperative and are presently used only for sludge storage. Sludge-digestion difficulties were experienced approximately 1-1/2 to 2 years after the plant went into operation in 1968. New industries were being continually tied into the plant, deteriorating the efficiency of digestion, until methane gas could not be produced, even after repeated attempts to seed the digesters. Plant personnel concluded that industries were discharging toxic materials that settled with the sludge in the clarifiers. The Director of the Pollution Control Department alleged that Proctor and Gamble was discharging NTA (Nitrilotriacetic acid), to the Kaw Point WWTP, which caused the digester failure. In late 1970 the Proctor and Gamble Company engaged the services of Dr. Perry McCarty* to investigate the digester problem. Dr. McCarty found that an inhibitory substance appeared to be present in the digesters.[1/] The sludge was analyzed for heavy metals in order to determine whether these were responsible for the poor performance. Results indicated that the metals were not responsible.

Dr. McCarty also analyzed the effluent from Proctor and Gamble. He determined that one particular waste stream (from a process that removed material created as a side reaction in the manufacture of an ammonia based compound) showed considerable inhibitory effects. This waste stream was recycled in the process. Other waste streams that were suspect were eliminated. The digesters still did not function.

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* Dr. McCarty is a consultant and professor of Sanitary Engineering, Stanford University, Palo Alto, California.

Because of the failure the digesters had approximately 18,920 m^3 (5 million gal.) of "dead" sludge. According to Mr. Cooke, the incinerators were operated for 196 hr/week instead of the normal 35 to 40 hr in order to reduce the volume of sludge to 10,600 m^3 (2.8 million gal). The remaining sludge was returned to the clarifiers and discharged to the river with the plant effluent. It was reported that the river turned black when the sludge was discharged but cleared up approximately 15 m (50 ft) downstream from the outfall. Records of operational procedure at Kaw Point show that the sludge was pumped directly to the river and not returned to the clarifiers. An anonymous letter sent to the Environmental Protection Agency stated that the sludge was discharged directly to the river.*

D. TREATMENT PLANT EVALUATION AND FINDINGS

On Friday, September 22, hourly grab samples of the influent and effluent were collected manually. After a 24-hr period the samples were composited on a flow-weighted basis, with hourly flow data supplied by the plant personnel. Similarly, six 24-hr composites of the influent and effluent were collected, on September 23 through 28, using SERCO automatic samplers. One effluent sample for analysis of phenols plus one effluent and one influent sample for oil-and-grease analysis were collected each day. Temperature, pH, and conductivity were measured periodically. [Chemical data and field measurements are summarized in Tables B-1, B-2, and B-3.]

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* The records of the Kaw Point Wastewater Treatment Plant and the anonymous letter are on file at the EPA Regional VII office, Kansas City, Missouri.

The average BOD and suspended solids loads discharged to the Missouri River were as follows:

Date	BOD (kg/day)	BOD (lb/day)	Suspended Solids (kg/day)	Suspended Solids (lb/day)
September 22	35,000	77,145	20,050	44,200
September 23-24	10,670	23,520	24,900	54,880
September 25-28	42,900	94,575	38,810	85,570

Removal efficiencies (7-day period) ranged from 7.5 to 21 percent for BOD and from 11.4 to 47 percent for suspended solids. These removal efficiencies were for less than the normally expected primary-treatment capabilities of 35 percent BOD removal and 65 percent suspended solids removal.[2/] Biochemical oxygen demand and total- and suspended-solids concentrations in the plant effluent were higher than concentrations of raw waste found in municipal systems.[2/]

The City of Kansas City, Kansas, Ordinance No. 42913 prohibits the discharge of harmful industrial wastes [Appendix I] and limits the 24-hr average concentrations of particular constituents received at the plant. The limits on heavy metals are:

Chromium	0.25 mg/l
Copper	0.5 mg/l
Cadmium	0.5 mg/l
Zinc	1.0 mg/l
Lead	0.2 mg/l

The concentrations of lead and chromium received at the plant exceeded

TABLE B-1

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
KAW POINT WASTEWATER TREATMENT PLANT
SEPTEMBER 22, 1972[a]

Parameter[b]	Influent	Effluent
Flow (m^3/day)	94,620	
Flow (mgd)	25	
pH (standard units), range	6.5-8.8	6.5-10.7
Temperature (°C), range	24-29	25.5-27.5
Conductivity (μmhos/cm), range	900-2,000	1,210-1,600
BOD	400	370
COD	1,410	777
TOC	250	200
Total Solids	1,360	1,300
Suspended Solids	392	212
Volatile Suspended Solids	300	156
Oil & Grease	410	170
Total Phosphorus as P		5.9
Ortho Phosphate as P		5.9
Total Kjeldahl Nitrogen-N		32.6
NH_3-N		20.6
NO_3 + NO_2-N		0.2
Phenols		
Total Lead	0.25	0.20
Total Zinc	0.51	0.49
Total Copper	0.066	0.049
Total Chromium	0.26	0.27
Total Cadmium	0.06	0.04
Total Mercury (μg/l)	3.2	6.9

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[a] All samples were collected manually.

[b] All values are reported as mg/l, except where specified.

TABLE B-2

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
KAW POINT WASTEWATER TREATMENT PLANT
SEPTEMBER 23-24, 1972

Parameter[a]	Influent	Effluent
Flow (m^3/day)	71,160	
Flow (mgd)	18.8	
pH (standard units), range	7.7-8.1	7.6-7.8
Temperature (°C), range	24-24.5	25-26
Conductivity (μmhos/cm), range	1,000-1,200	1,200
BOD	[illegible]	150
COD	650	470
TOC	160	160
Total Solids	1,500	1,400
Suspended Solids	395	350
Volatile Suspended Solids	287	285
Oil & Grease	80	59
Total Phosphorus as P		5.6
Ortho Phosphate as P		3.3
Total Kjeldahl Nitrogen-N		38.5
NH_3-N		28.5
NO_3 + NO_2-N		1.7
Phenols		2.0
Total Lead	0.13-0.30	0.14-0.15
Total Zinc	0.28-0.34	0.20-0.80
Total Copper	0.041-0.044	0.026-0.054
Total Chromium	0.57-2.12	0.17-0.69
Total Cadmium	0.04-0.05	0.03-0.05
Total Mercury (μg/l)	1.3-1.5	1.8

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[a] All values are reported as mg/l, except where specified.

TABLE B-3

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
KAW POINT WASTEWATER TREATMENT PLANT
SEPTEMBER 25-28, 1972

Parameter[a]	Influent	Effluent
Flow (m^3/day)	102,200	
Flow (mgd)	27	
pH (standard units), range	7.0-7.8	6.9-7.6
Temperature (°C), range	25-28	23-28
Conductivity (µmhos/cm), range	1,150-3,750	1,300-1,800
BOD	490	420
COD	1,590	865
TOC	260	220
Total Solids	1,830	1,475
Suspended Solids	720	380
Volatile Suspended Solids	620	290
Oil & Grease	78	69
Total Phosphorus as P		10.4
Ortho Phosphate as P		7.4
Total Kjeldahl Nitrogen-N		31.5
NH_3-N		22.2
NO_3 + NO_2-N		0.3
Phenols		2.0
Total Lead	0.17-0.25	0.17-0.20
Total Zinc	0.60-0.80	0.43-1.00
Total Copper	0.048-0.072	0.053-0.061
Total Chromium	0.14-0.48	0.16-0.73
Total Cadmium	0.02-0.05	0.02-0.05
Total Mercury (µg/l)	0.9-1.6	0.9-4.6

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[a] All values are reported as mg/l, except where specified.

the specified limitations. The average concentration of phenols discharged to the Missouri River was 2.0 mg/l. The ordinance does not prohibit phenols from being discharged to the treatment plant.

All samples of oil and grease collected from both the influent and effluent were well mixed. The average concentration of oil and grease received at the treatment plant was 79 mg/l (range: 47-410 mg/l) and corresponds to at least 6,830 kg/day (15,050 lb/day). On Friday afternoon, September 22, the influent oil-and-grease concentration was 410 mg/l (grab sample). This high concentration might have been due to a slug discharge from industrial clean-up operations. The effluent oil-and-grease concentration was also high, 170 mg/l. For a prolonged period of time concentrations of this magnitude could cause obstructions in the sewers or interfere with treatment equipment. The ordinance does not limit the concentrations of oil and grease that can be discharged.*

E. SUMMARY AND CONCLUSIONS

1. The Kaw Point plant experienced several operational difficulties. Only three of the four clarifiers can be used at one time, or the waste becomes septic due to the prolonged detention time. The digesters have been used for storage for several years because of toxic materials in the sludge. All sludge is now incinerated, although, in the past, it was frequently discharged to the river.

2. The plant influent and effluent averaged 412 mg/l and 355 mg/l BOD and 600 mg/l and 348 mg/l suspended solids, respectively; the levels

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* It is common practice for industrial waste ordinances to prohibit the discharge of all insoluble oil and grease and to limit the discharge of soluble oil and grease to 100 mg/l.

for each parameter are considerably higher than those normally found in municipal systems. The plant did not achieve normal primary-treatment removal efficiencies for BOD or suspended solids, and more adequate treatment measures are required.

3. Ordinance No. 42913 is not practical. Specific limits of heavy metals are based on average 24-hr concentrations received at the treatment plant (which does not prevent slug discharges with high concentrations); toxic-materials limitations are not specified. The ordinance does not prohibit the discharge of phenols, neither does it specify limits for oil and grease.

4. Disinfection was not provided. Bacterial densities in the Missouri River increased downstream from the effluent [See Chapter V] and violated the Missouri and Kansas water quality criteria for bacteria.

F. RECOMMENDATIONS

It is recommended that:

1. Secondary-treatment effluent limitations for publicly owned treatment works established pursuant to the 1972 Amendments be met by December 31, 1975, and that maximum waste loads be predicated on the basis of effluent limitations (e.g. concentration of BOD and suspended solids and present design flow);

2. The BOD and suspended solids in the effluent from the wastewater treatment plants each not exceed a monthly average of 30 mg/l and weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better water quality by December 31, 1975 (this quality of effluent being achievable through a well-operated secondary plant);

3. The fecal-coliform bacterial density in the effluent from the wastewater plants shall not exceed a weekly average of 400/100 ml and a monthly average of 200/100 ml;

4. Owing to the high percentage of industrial wastes in the influent to the Kaw Point Wastewater Treatment Plant to the equally high probability that toxic materials can enter the plant, concurrent biological and physical-chemical treatment process pilot-plant studies of the Kaw Point influent be conducted, to last for several months, in order to determine reliability before a full-scale plant is designed (the pilot plant studies not being used as a basis to obtain an extension of the December 31, 1975, deadline for secondary treatment);

5. In order to reduce the amount of contaminants entering the Missouri River and to upgrade the existing plant to achieve primary treatment efficiencies until a secondary plant can be put on line, the Kaw Point Wastewater Treatment Plant staff proceed immediately with testing procedures on the influent to determine possible treatment methods to remove additional amounts of BOD and suspended solids and immediately apply the results to the full-scale plant;

6. The City of Kansas City, Kansas, establish pretreatment regulations for industries discharging to the municipal sewers, thus requiring the removal of pollutants and toxic substances not susceptible to treatment or that would either interfere with the operation of the treatment works or pass through the public systems in concentrations or loads inconsistent with effluent limitations for secondary treatment plants established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

B-II. TOWNSHIP WASTEWATER TREATMENT PLANTS
KANSAS CITY, KANSAS

A. GENERAL

Waste collected by the trunk sewers within the study area is treated in six separate treatment facilities [Figure 1.]. Treatment Plants No 5, 6, and 9 have secondary treatment facilities, and Plants No. 7, 8, and 20 provide primary treatment. More than 95 percent of the flow is domestic waste. The effluents from these plants are not disinfected.

Each primary plant has two sludge digesters. However, plant personnel have been unable to make the digesters operate properly (i.e., produce methane gas). Therefore, the digesters are not used. Settled solids from the six plants are routinely pumped into a 11.4 m^3 (3,000-gal.) tank truck, hauled to the Kaw Point WWTP, and added to the influent.

Plants No. 7, 9, and 20 have Parshall flumes to measure influent flows. However, flow-measuring and recording equipment was not installed. Plants No. 5, 6, and 8 do not have flow-measuring facilities.

Plants No. 5 and 6 will be abandoned once the Turkey Creek Interceptor sewer is constructed, but contracts have not been let for this project. Present plans are to expand Plants No. 8 and 20 to secondary treatment.

EPA personnel evaluated Plants No. 5, 6, and 8 on September 15 through 17, 1972, and on September 30 through October 2, 1972, Plants No. 7, 9, and 20.

B. WASTE TREATMENT FACILITIES

1. Plant No. 5 -- This facility serves areas adjacent to Turkey

Creek and is located at 24th Street and Lamar. The design flow is 1,045 m^3/day (0.276 mgd). The effluent is discharged into Turkey Creek. The treatment facilities [Figure B-2] include:

a) Preliminary treatment--manually cleaned bar screen followed by a lift station;

b) Primary treatment--two-cell Imhoff tank with one common compartment for sludge; and

c) Secondary treatment--one 24.4 m (80-ft) dia. trickling filter followed by a secondary clarifier (3.7 m or 12 ft wide by 15.8 m or 52 ft long). Sludge from the secondary clarifier is returned to the influent, ahead of the bar screen.

The flow was measured by attaching time meters to the constant speed, lift-station pumps. Each pump was turned on individually, and the effluent from the clarifier measured with a current meter. This determined the amount of effluent flow per unit of time of operation for each pump. The total effluent flow for each day was calculated from the total time each pump operated.

2. Plant No. 6 -- This facility also serves areas adjacent to Turkey Creek and is located at 4708 Shawnee Drive. The design flow is 1,415 m^3/day (0.374 mgd). The effluent discharges to a small tributary of Turkey Creek and constitutes the only flow during dry weather. Treatment facilities [Figure B-3] include:

B-16-A

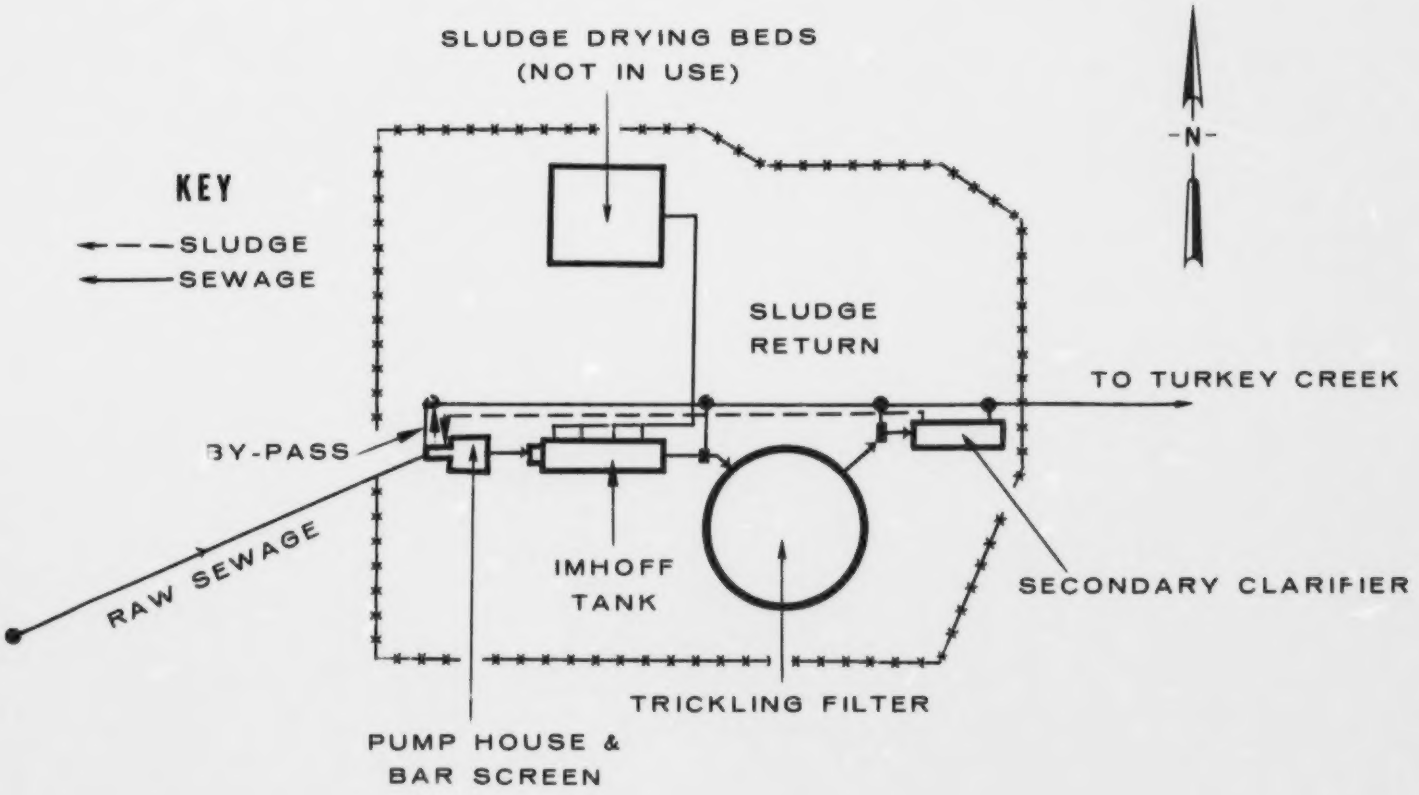
SLUDGE DRYING BEDS
(NOT IN USE)
-N-
KEY
SLUDGE
SEWAGE
SLUDGE
RETURN
TO TURKEY CREEK
BY-PASS
RAW SEWAGE
IMHOFF
TANK
SECONDARY CLARIFIER
TRICKLING FILTER
PUMP HOUSE &
BAR SCREEN

Figure B-2. Kansas City, Kansas Wastewater Treatment Plant No. 5

B.16.B

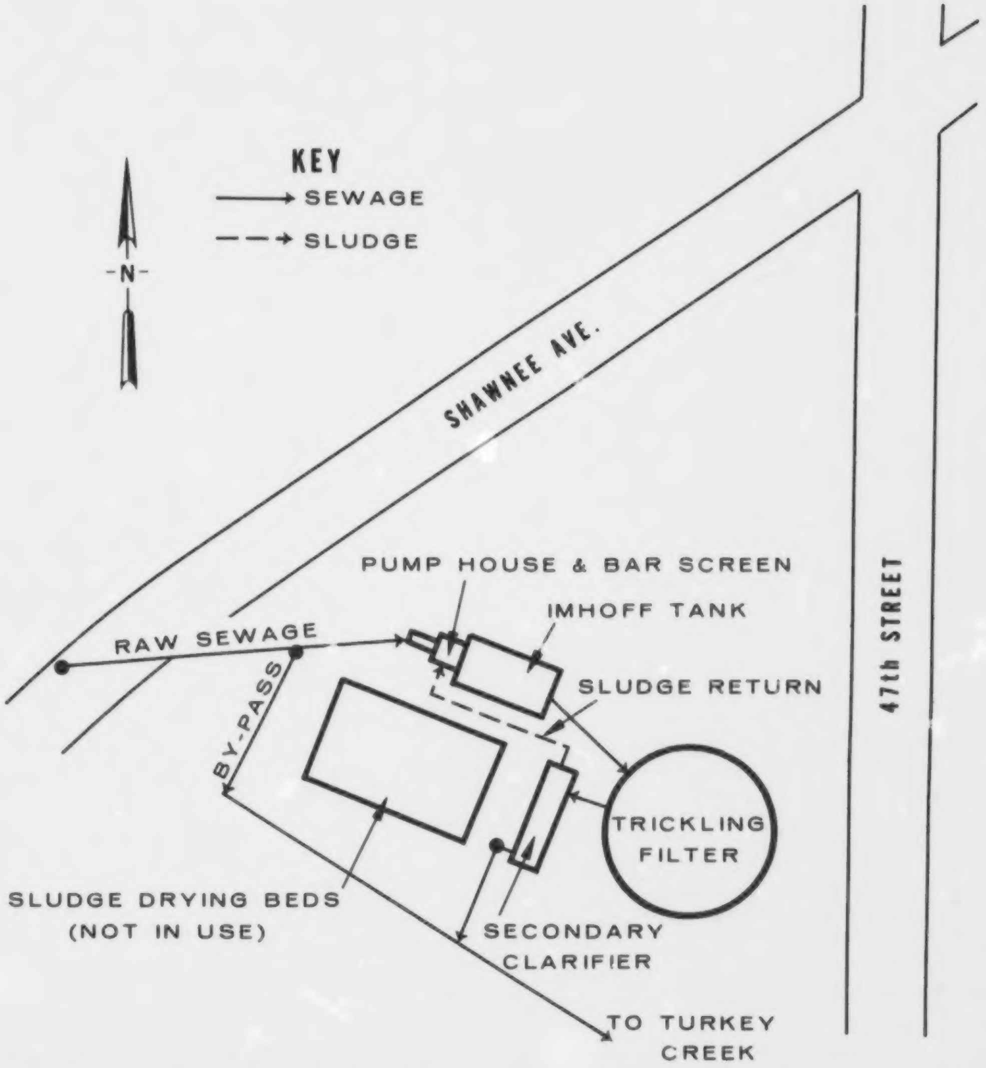
KEY
SEWAGE
SLUDGE
N
SHAWNEE AVE.
47th STREET
PUMP HOUSE & BAR SCREEN
IMHOFF TANK
SLUDGE RETURN
RAW SEWAGE
BY-PASS
TRICKLING FILTER
SLUDGE DRYING BEDS
(NOT IN USE)
SECONDARY CLARIFIER
TO TURKEY CREEK

Figure B-3. Kansas City, Kansas Wastewater Treatment Plant No. 6

a) Preliminary treatment--manually cleaned bar screen followed by a lift station;

b) Primary treatment--two-cell Imhoff tank with one common compartment for sludge;

c) Secondary treatment--one 32-m (105 ft) dia. trickling filter followed by a secondary clarifier (4 m or 13 ft wide by 20.7 m or 68 ft long). Sludge from the clarifier is returned to the influent ahead of the bar screen.

The flow was measured in the same manner as that at Plant No. 5.

3. Plant No. 7 -- This plant is located at 55th Street and Kaw Drive. The design flow is 15,140 m^3/day (4 mgd). The effluent is discharged directly to the Kansas River (RM 367.5/8.5). The treatment facilities [Figure B-4] include:

a) Preliminary treatment--45.7-cm (18 in.) Parshall flume followed by bar screen, lift station, and grit channel; and

b) Primary treatment--two primary sedimentation basins, with common-wall construction. (Overall dimensions: 11.45 m or 37 ft 7 in. wide by 30.5 m or 100 ft long.) Each basin is divided into two cells. There are two digesters, each with a capacity of 780 m^3 (205,000 gal).

The flow was measured by installing a continuous-flow recorder in the Parshall flume.

4. Plant No. 8 -- This plant is located at 59th Street and Inland Drive. The design flow is 1,325 m^3/day (0.35 mgd). The effluent discharges to the Kansas River via Barber Creek (RM 367.5/10)

because the effluent pipe, running under the stream, was broken and never repaired. If repaired, the effluent would discharge directly to the Kansas River (RM 367.5/9.3). The treatment facilities [Figure B-5] include:

a) Preliminary treatment--bar screen followed by a lift station; and

b) Primary treatment--two sedimentation basins, common wall construction (overall dimensions: 3.4 m or 11 ft wide by 11.6 m or 38 ft long), with two digesters each with a capacity of about 130 m^3 (35,000 gal.)

A 90° V-notch weir was installed in the wet well, and the influent flow measured with a continuous-flow recorder.

5. Plant No. 9 -- This facility, located at 82nd Street and Riverview, consists of two separate systems treating the flows from two trunk sewers. The effluent from the trickling-filter facility flows into the aerated lagoon facility. The combined effluent from both systems discharges into Little Turkey Creek which flows into the Kansas River (RM 367.5/11.8). The treatment facilities [Figure B-6] include:

a) Plant 9A (Trickling Filter) --

   i) preliminary treatment--15.2-cm (6 in.) Parshall flume followed by bar screens and a lift station;

   ii) primary treatment--two-cell Imhoff tank with common compartment for sludge; and

   iii) secondary treatment--one 21-m (69 ft) dia. trickling

B.18-A

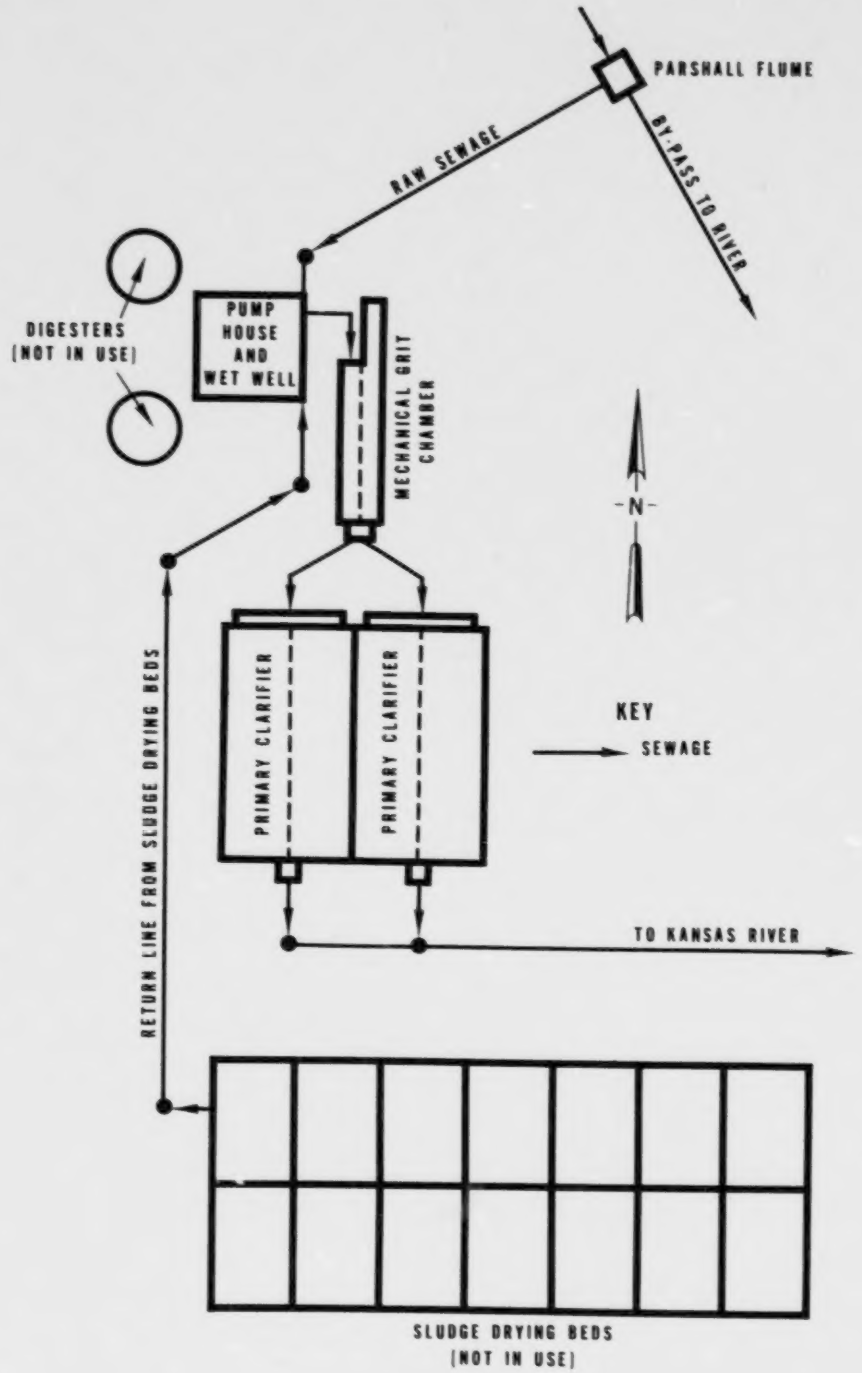
PARSHALL FLUME
RAW SEWAGE
BY-PASS TO RIVER
DIGESTERS
(NOT IN USE)
PUMP HOUSE AND WET WELL
MECHANICAL GRIT CHAMBER
-N-
PRIMARY CLARIFIER
PRIMARY CLARIFIER
KEY
SEWAGE
RETURN LINE FROM SLUDGE DRYING BEDS
TO KANSAS RIVER
SLUDGE DRYING BEDS
(NOT IN USE)

Figure B-4. Kansas City, Kansas Wastewater Treatment Plant No. 7

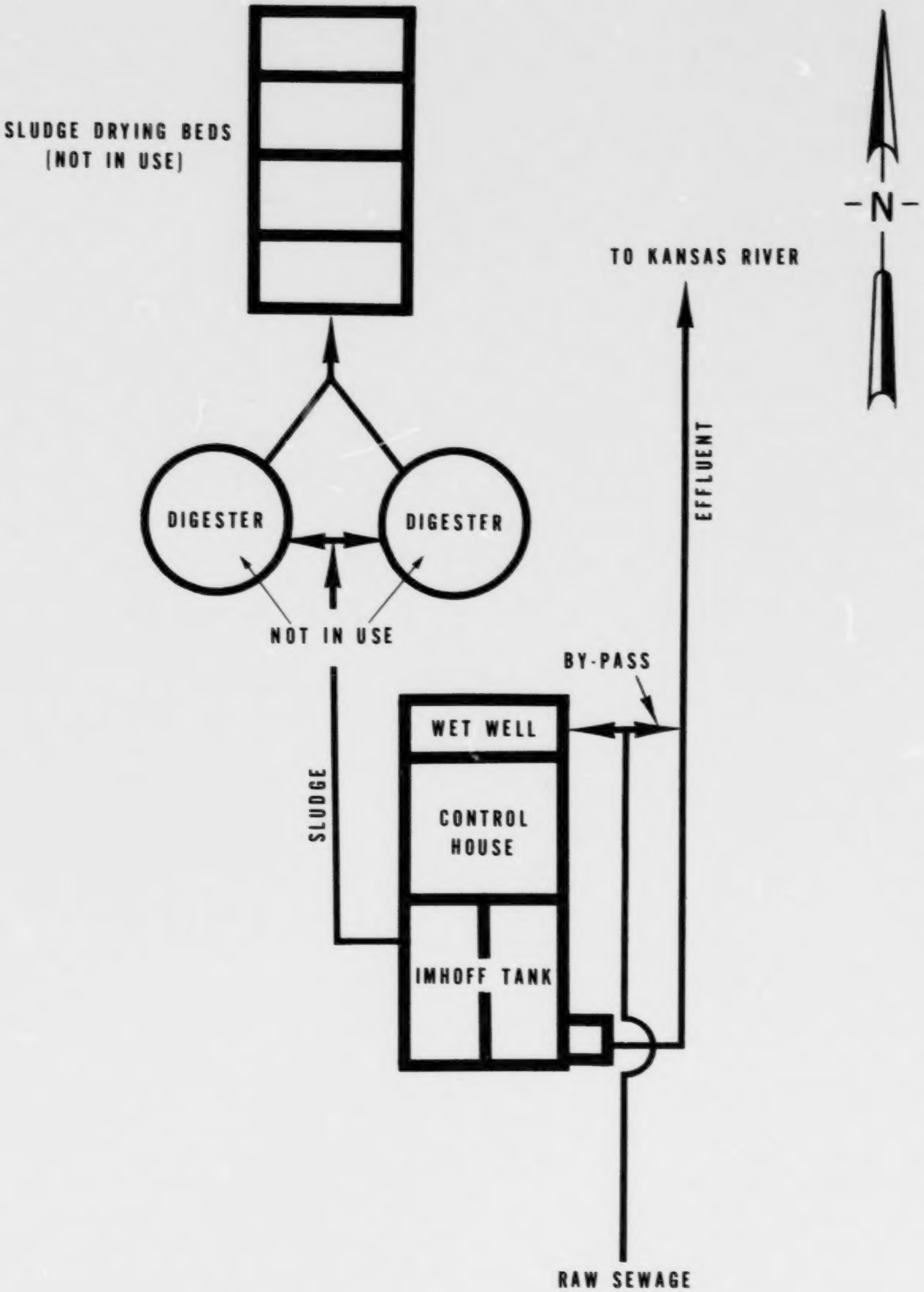
SLUDGE DRYING BEDS
(NOT IN USE)
-N-
TO KANSAS RIVER
EFFLUENT
DIGESTER
DIGESTER
NOT IN USE
BY-PASS
WET WELL
SLUDGE
CONTROL HOUSE
IMHOFF TANK
RAW SEWAGE

Figure B-5. Kansas City, Kansas Wastewater Treatment Plant No. 8

B-18-C

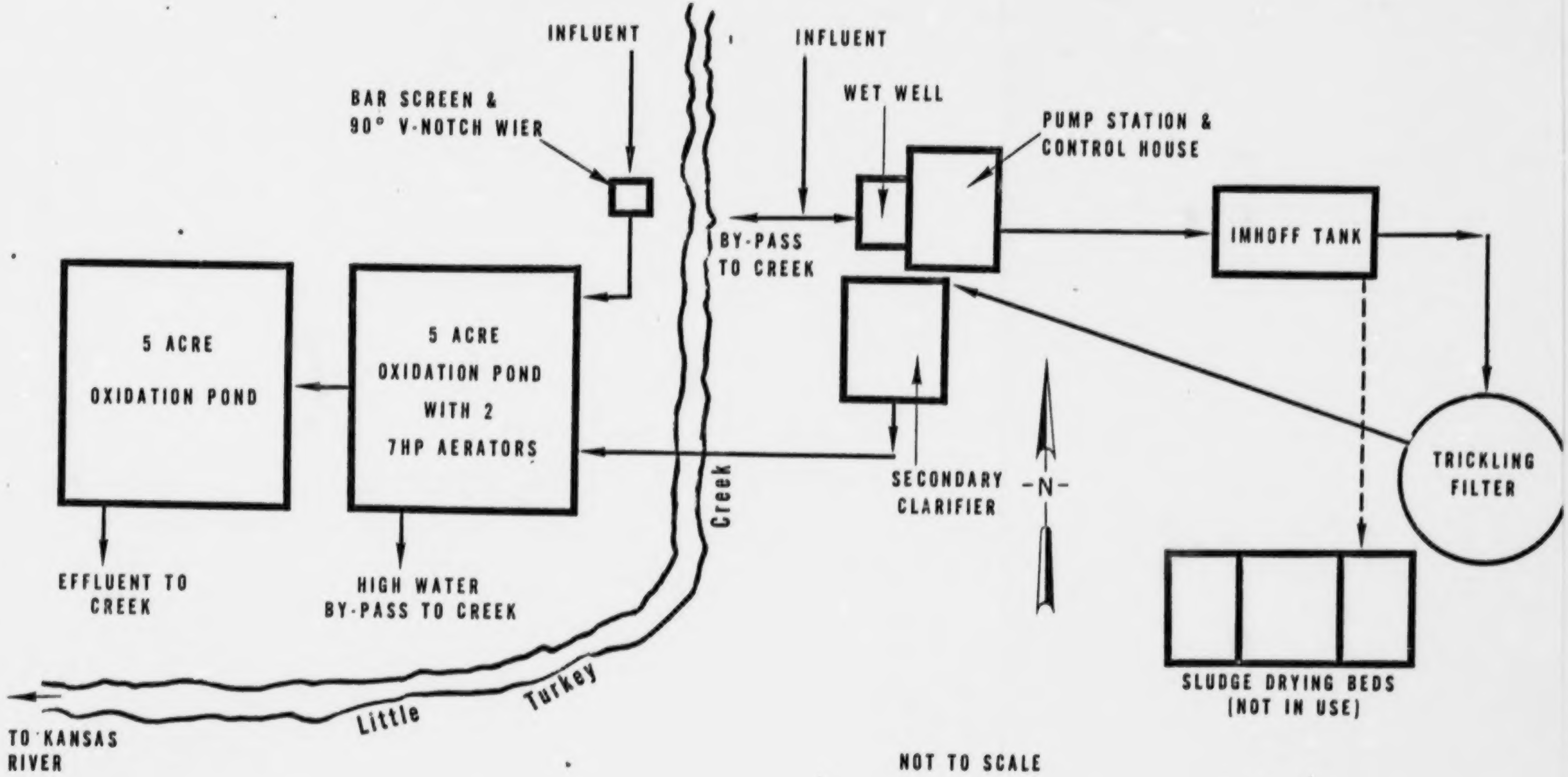
INFLUENT
BAR SCREEN & 90° V-NOTCH WIER
INFLUENT
WET WELL
PUMP STATION & CONTROL HOUSE
BY-PASS TO CREEK
IMHOFF TANK
5 ACRE OXIDATION POND
5 ACRE OXIDATION POND WITH 2 7HP AERATORS
SECONDARY CLARIFIER
-N-
TRICKLING FILTER
Creek
EFFLUENT TO CREEK
HIGH WATER BY-PASS TO CREEK
Little Turkey
SLUDGE DRYING BEDS (NOT IN USE)
TO KANSAS RIVER
NOT TO SCALE

Figure B-6. Kansas City, Kansas Wastewater Treatment Plant No. 9

filter followed by a secondary clarifier (3.4 m or 11 ft wide by 11.9 m or 39 ft long) with sludge from the clarifier recycled back to the influent wet well downstream from the bar screens and flume.

The flow was measured by installing a continuous flow recorder in the Parshall flume.

b) Plant 9B (Lagoon System) --

   i) preliminary treatment--splitter box followed by bar screen; and

   ii) primary and secondary treatment--two 20,235-m^2 (5 acres) lagoons operated in series--the first cell having two 5.22-kilowatt (7 hp) surface aerators and receiving the effluent from Plant 9A.

The flow was measured by installing a 90° V-notch weir and a continuous-flow recorder in the splitter box.

6. Plant No. 20 -- The facility is located at 78th and Kaw Drive. The design flow is 3,785 m^3/day (1 mgd). The effluent discharges directly to the Kansas River (RM 367.5/11.4). The treatment facilities [Figure B-7] include:

   a) Preliminary treatment--bar screen, manually cleaned grit chamber and a 22.9-cm (9 in.) Parshall flume.

   b) Primary treatment--two sedimentation basins with common-wall construction (overall dimensions: 11.6 m or 38 ft wide by 24.4 m or 80 ft long) having two digesters with 570 m^3 (150,000-gal.) capacity each.

The flow was measured by installing a continuous flow recorder in the Parshall flume.

C. OPERATION AND MAINTENANCE PROCEDURES

Two crews, each consisting of three men, operate and maintain the six plants. On each week day the crews spend about two hr at each plant. There are no routine operational tasks assigned to either crew. Attempts are made to correct problems as they occur.

Daily maintenance procedures at the plants are as follows.

1. Clean the bar screen.
2. Remove grit from grit chambers.
3. Break up scum layer and scum accumulation on the overflow weir in primary sedimentation units.
4. Free gas vents on each Imhoff tank and chain the slots.
5. Check the packing glands on lift pumps.
6. Check sump pumps for proper operation.

Weir notches are cleaned on a weekly basis. Grounds maintenance is a summer function and is performed by part-time summer personnel.

D. TREATMENT PLANT EVALUATION AND FINDINGS

For a three-day period that included a weekend, the influent and effluent of each plant were sampled using SERCO automatic samplers. Samples were composited on an equal-volume basis at the end of each 24-hour period. One grab sample per day for oil-and-grease analysis was collected from the effluent. In the receiving stream, grab samples for bacteriological analyses were collected upstream of and downstream from the discharges of treatment Plants No. 5, 6, 8, and 9. Bacteriological

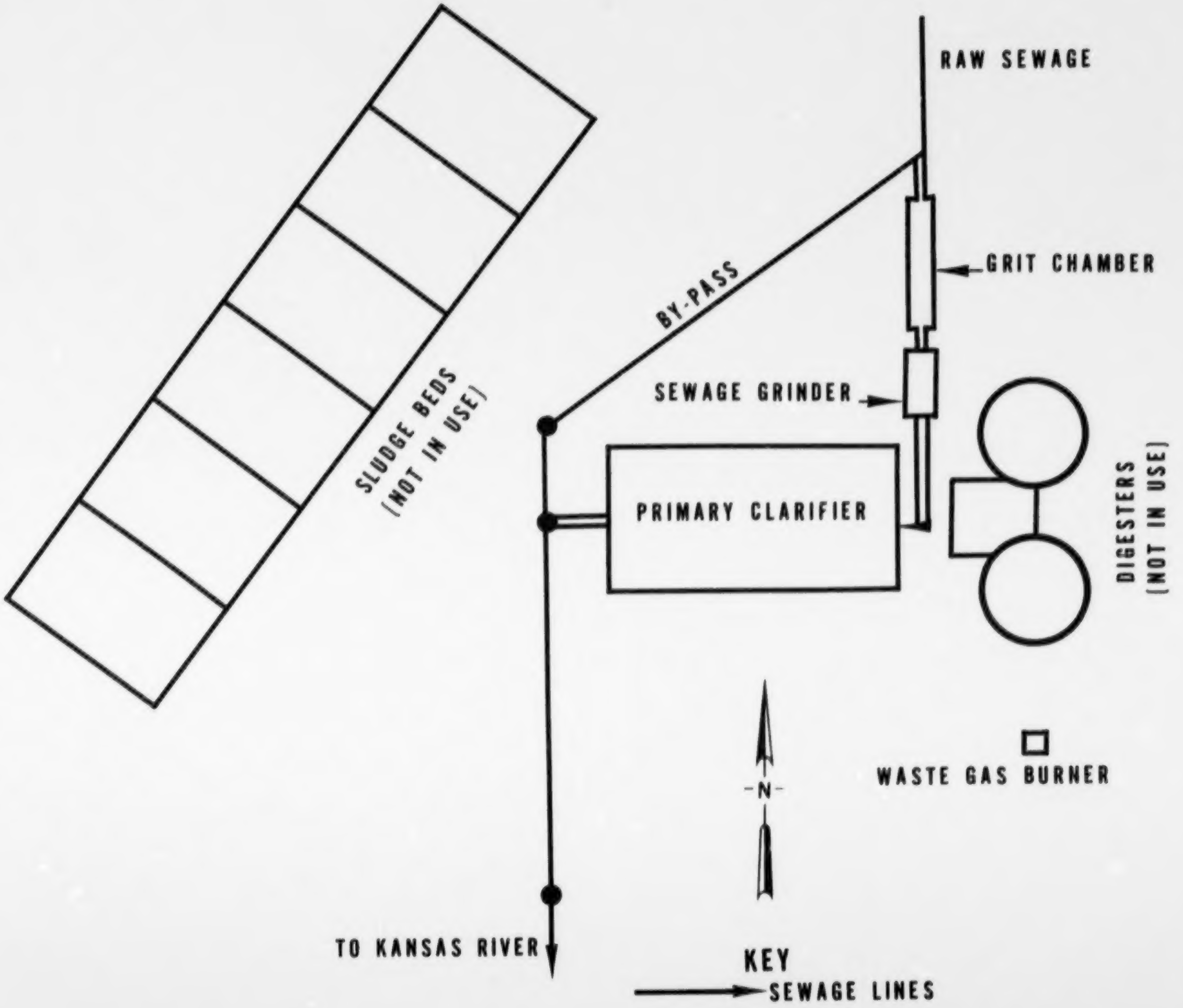
RAW SEWAGE
GRIT CHAMBER
BY-PASS
SEWAGE GRINDER
SLUDGE BEDS
(NOT IN USE)
PRIMARY CLARIFIER
DIGESTERS
(NOT IN USE)
WASTE GAS BURNER
N
TO KANSAS RIVER
KEY
SEWAGE LINES

Figure B-7. Kansas City, Kansas Wastewater Treatment Plant No. 20

samples were not collected at Plants No. 7 and 20 because they discharge directly to the Kansas River, and violations of Kansas water-quality criteria for bacteria had been demonstrated in July 1972 [Chapter VI]. Field measurements for pH, temperature, and conductivity were made periodically. [Chemical and bacteriological data and field measurements are summarized in Tables B-4 through B-13.]

Of the three primary treatment plants, only Plant No. 8 was operating efficiently. Removals of BOD and suspended solids from the influent levels were 41 percent and 84 percent, respectively. However, the levels of BOD and suspended solids in the plant were stronger than those in normal, domestic waste; consequently effluent concentrations were high.

Plants No. 7 and 20 were each removing only 44 percent of the suspended solids. These plants removed 26 and 9 percent, respectively, of the incoming BOD. Neither plant was overloaded hydraulically. Characteristics of the raw waste indicate that it was primarily domestic sewage.

Only Plant No. 6 was operating at the efficiency defined by the Kansas water quality criteria for secondary treatment (85 percent BOD removal). The efficiencies measured at the secondary plants are tabulated:

Plant No.	BOD Removal percent	Suspended Solids Removal percent
5	83	84
6	92	85
9A (Trickling Filter)	70	64
9B (Lagoon)	80	92
9 (combined)	83	93

TABLE B-4

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, KANSAS, WASTEWATER TREATMENT PLANT NO. 5[a]
SEPTEMBER 15-17, 1972

Parameter[b]	Influent	Effluent
Flow (m^3/day)		1,010
Flow (mgd)		0.267
pH (standard units), range	6.9-7.3	7.1-7.3
Temperature (°C), range	22-25	22-25
Conductivity (µmhos/cm), range	900-1,400	1,025-1,475
BOD	270	46
COD	995	250
TOC	155	45
Total Solids	1,290	620
Suspended Solids	360	58
Volatile Suspended Solids	315	42
Oil & Grease		16
Total Phosphorus as P		18.1
Ortho Phosphate as P		14.6
Total Kjeldahl Nitrogen-N		16
NH_3-N		9.0
NO_3 + NO_2-N		5.6

---

[a] This is a secondary treatment plant.
[b] All values are reported as mg/l, except where specified.

TABLE B-5

SUMMARY OF BACTERIOLOGICAL RESULTS, TURKEY CREEK
SEPTEMBER 16-18, 1972

Location	Range[a]	Log Mean[a]	Percentage in Excess of 4,000/100 ml
Upstream of WWTP No. 5			
Total coliform	86,000-360,000	180,000	
Fecal coliform	2,400-8,400	5,400	67
Fecal Streptococci	2,000-3,700	2,600	
Downstream of WWTP No. 5			
Total coliform	370,000-3,100,000	1,000,000	
Fecal coliform	15,000-86,000	31,000	100
Fecal Streptococci	2,600-25,000	6,000	

---

[a] All values are expressed as number/100 ml, using MF Technique; the value is based on six samples per station.

TABLE B-6

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, KANSAS, WASTEWATER TREATMENT PLANT NO. 6[a]

SEPTEMBER 15-17, 1972

Parameter[b]	Influent	Effluent
Flow (m^3/day)		1,980
Flow (mgd)		0.524
pH (standard units), range	6.9-7.6	6.9-7.4
Temperature (°C), range	22-25	23-25
Conductivity (μmhos/cm), range	1,000-1,300	950-1,200
BOD	385	30
COD	795	165
TOC	215	30
Total Solids	1,330	795
Suspended Solids	260	40
Volatile Suspended Solids	210	32
Oil & Grease		20
Total Phosphorus as P		18.2
Ortho Phosphate as P		16.1
Total Kjeldahl Nitrogen-N		10.2
NH_3-N		5.7
NO_3 + NO_2-N		3.8

---

a/ This is a secondary treatment plant.

b/ All values are reported as mg/l, except where specified.

TABLE B-7

SUMMARY OF BACTERIOLOGICAL RESULTS, UNNAMED CREEK DISCHARGING TO TURKEY CREEK

SEPTEMBER 16-18, 1972

Location	Range[a]	Log Mean[a]	Percentage in Excess of 4,000/100 ml
Upstream of WWTP No. 8			
Total coliform	9,000-230,000	44,000	
Fecal coliform	150-2,900	890	0
Fecal streptococci	750-72,000	14,000	
Downstream of WWTP No. 8			
Total coliform	950,000-16,000,000	7,300,000	
Fecal coliform	39,000-290,000	160,000	100
Fecal streptococci	7,000-64,000	29,000	

---

a/ All values are expressed as number/100 ml, using MF technique; the value is based on six samples per station.

TABLE B-8

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, KANSAS, WASTEWATER TREATMENT PLANT NO. 7[a/]

SEPTEMBER 30-OCTOBER 2, 1972

Parameter[b/]	Influent	Effluent
Flow (m^3/day)	7,380	
Flow (mgd)	1.95	
pH (standard units), range	7.0-7.4	6.7-7.2
Temperature (°C), range	18.5-23	18.5-22
Conductivity (μmhos/cm), range	1,100-1,400	1,100-1,250
BOD	290	215
COD	685	455
TOC	185	115
Total Solids	1,030	970
Suspended Solids	325	180
Volatile Suspended Solids	275	115
Oil & Grease		25
Total Phosphorus as P		16.0
Ortho Phosphate as P		11.5
Total Kjeldahl Nitrogen-N		35.1
NH_3-N		25.0
$NO_3 + NO_2$-N		0.47

---

a/ This is a primary treatment plant.

b/ All values are reported as mg/l, except where specified.

TABLE B-9

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, KANSAS, WASTEWATER TREATMENT PLANT NO. 8[a]
SEPTEMBER 15-17, 1972

Parameter[b]	Influent	Effluent
Flow (m^3/day)	630	
Flow (mgd)	0.166	
pH (standard units), range	6.5-7.6	6.6-7.0
Temperature (°C), range	22-25	22-25
Conductivity (μmhos/cm), range	1,050-1,400	1,100-1,400
BOD	395	235
COD	810	635
TOC	280	135
Total Solids	1,485	945
Suspended Solids	700	110
Volatile Suspended Solids	550	80
Oil & Grease		48
Total Phosphorus as P		21.2
Ortho Phosphate as P		17.7
Total Kjeldahl Nitrogen-N		43.3
NH_3-N		37.1
$NO_3 + NO_2$-N		0.1

---

[a] This is a primary treatment plant.

[b] All values are reported as mg/l, except where specified.

TABLE B-10

SUMMARY OF BACTERIOLOGICAL RESULTS, BARBER CREEK
SEPTEMBER 16-18, 1972

Location	Range[a]	Log Mean[a]	Percentage in Excess of 4,000/100 ml
Upstream of WWTP No. 8			
Total coliform	19,000-110,000	38,000	
Fecal coliform	370-2,600	1,100	0
Fecal streptococci	1,600-6,900	2,800	
Downstream from WWTP No. 8			
Total coliform	6,700,000-34,000,000	15,000,000	
Fecal coliform	290,000-1,000,000	580,000	100
Fecal streptococci	8,300-110,000	48,000	

---

[a] All values are expressed as number/100 ml, using MF technique; the value is based on six samples per station.

TABLE B-11

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, KANSAS, WASTEWATER TREATMENT PLANT NO. 9[a] SEPTEMBER 30-OCTOBER 2, 1972

Parameter[b]	Plant A (Trickling Filter) Influent	Plant A (Trickling Filter) Effluent	Plant B (Lagoon) Influent[c]	Plant B (Lagoon) Effluent
Flow (m^3/day)	136		829	
Flow (mgd)	0.036		0.219	
pH (standard units), range	7.0-7.8	7.1-7.7	6.8-7.7	7.3-8.8
Temperature (°C), range	21.5-26	19-24.5	18.5-24.5	13.5-21.5
Conductivity (µmhos/cm), range	950-1,800	1,000-1,400	850-1,600	850-1,100
BOD	310	100	250	50
COD	940	310	575	165
TOC	165	70	130	38
Total Solids	1,435	1,005	1,120	760
Suspended Solids	455	125	375	30
Volatile Suspended Solids	405	92	315	25
Oil & Grease		68		11
Total Phosphorus as P		16.3		6.8
Ortho Phosphate as P		16.3		6.2
Total Kjeldahl Nitrogen-N		22.4		14.2
NH_3-N		14.6		5.7
NO_3 + NO_2-N		1.8		0.3

[a] This is a secondary treatment plant.

[b] All values are reported as mg/l, except where specified.

[c] This flow includes effluent from Plant A and untreated influent to Plant B.

TABLE B-12

SUMMARY OF BACTERIOLOGICAL RESULTS, LITTLE TURKEY CREEK OCTOBER 1-3, 1972

Location	Range[a]	Log Mean[a]	Percentage in Excess of 4,000/100 ml
Upstream of WWTP No. 9			
Total coliform	2,000-16,000	4,500	
Fecal coliform	150-2,600	230	0
Fecal streptococci	470-1,500	810	
Downstream from WWTP No. 9			
Total coliform	80,000-530,000	218,000	
Fecal coliform	1,500-10,000	4,400	50
Fecal streptococci	560-3,000	1,300	

[a] All values expressed as number/100 ml, using MF technique; The value is based on six samples per station.

TABLE B-13

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, KANSAS, WASTEWATER TREATMENT PLANT NO. 20[a]

SEPTEMBER 30-OCTOBER 2, 1972

Parameter[b]	Influent	Effluent
Flow (m^3/day)	3,070	
Flow (mgd)	0.81	
pH (standard units), range	7.0-7.6	6.7-7.2
Temperature (°C), range	21-24.5	20.5-24
Conductivity (µmhos/cm), range	1,250-2,000	1,000-1,325
BOD	215	195
COD	570	370
TOC	110	100
Total Solids	1,040	845
Suspended Solids	170	95
Volatile Suspended Solids	125	75
Oil & Grease		36
Total Phosphorus as P		17.8
Ortho Phosphate as P		16.6
Total Kjeldahl Nitrogen-N		31.0
NH_3-N		25.4
NO_3 + NO_2-N		<0.1

---

[a] This is a primary treatment plant.

[b] All values are reported as mg/l, except where specified.

The Federal Water Pollution Control Act Amendments of 1972 require that effluent limitations based on secondary treatment must be established by July 1, 1977. An effluent containing 30 mg/l of suspended solids as a monthly average and 45 mg/l as a weekly average is attainable through secondary treatment. Treatment must be improved in order to achieve an effluent of this quality.

Fecal coliform bacteria in all downstream receiving water samples exceeded the level established by the State of Kansas for intermittent streams, 4,000/100 ml. Upstream of the discharges the bacterial densities were lower than this level except at the Turkey Creek Station, upstream of Plant No. 5. Sixty-seven percent of the samples at this location contained greater than 4,000 fecal coliforms/100 ml. Plant No. 6 which discharges approximately 2.1 km (1.3 miles) upstream of Plant No. 5 was responsible for the high densities. During the study these discharges caused violations of Kansas water-quality criterion for fecal coliform bacteria in intermittent streams.

E. SUMMARY AND CONCLUSIONS

1. Treatment Plants No. 7, 8, and 20 are primary facilities. Plant No. 8 was the only one achieving normal primary treatment for BOD and suspended solids.

2. Treatment Plants No. 5, 6, and 9 are secondary plants. All three plants were removing approximately 85 percent of the BOD and suspended solids.

3. The treatment plants are not maintained or operated properly. Digester facilities have been abandoned. Settled solids from the primary

clarifier at each plant are hauled to the Kaw Point plant for incineration. Flow-measuring equipment at Plants No. 7, 9, and 20 was not being used. No flow-measuring equipment was available at Plants No. 5, 6 and 8.

4. The effluents from the plants were not disinfected. The fecal-coliform bacteria violated the State of Kansas water-quality criterion for Turkey Creek, Little Turkey Creek, Barber Creek, and for the unnamed tributary of Turkey Creek.

F. RECOMMENDATIONS

It is recommended that:

1. Secondary treatment effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972 be met by December 31, 1975, and maximum waste loads be predicated on the basis of effluent limitations (e.g., concentration of BOD and suspended solids and present design flow);

2. The BOD and suspended solids in the effluent from the wastewater treatment plants each not exceed a monthly average of 30 mg/l and weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better water quality (this quality of effluent being achievable through a well-operated secondary plant);

3. The fecal-coliform bacterial density in the effluent from the wastewater plants shall not exceed a weekly average of 400/100 ml and a monthly average of 200/100 ml;

4. A course of action be implemented to eliminate the continued reliance upon numerous small wastewater treatment plants now in use and to provide for a regional treatment system.

B-III. WEST SIDE WASTEWATER TREATMENT PLANT
KANSAS CITY, MISSOURI

A. GENERAL

The West Side facility, located approximately one-half kilometer east of the Kansas City, Kansas, Kaw Point WWTP, serves the central industrial district, the old municipal airport, and a portion of the downtown commercial area [Figure 1]. The major facilities include a) the Turkey Creek sewage pumping station and force main, b) the Santa Fe sewage pumping station, and c) the West Side Wastewater Treatment Plant. The area is served by a system of combined sewers carrying storm water, domestic waste, and industrial waste. Both pumping stations have been designed to intercept the flows and to by-pass when the wet-weather flow is greater than two and one-quarter times the dry-weather flow; the treatment plant has never by-passed. The combination of sewage and industrial wastes have a BOD strength equivalent to a population of 662,000.

From September 22 through 28, 1972, EPA personnel conducted an in-plant evaluation. John D. Reece, chief of the treatment division, Pollution Control Department, City of Kansas City, Missouri, provided assistance and information.

B. WASTE TREATMENT FACILITIES

The plant was designed for an average flow of 113,550 m^3/day (30 mgd) and a maximum flow of 255,500 (67.5 mgd). The treatment facilities [Figure B-8] include:

1. Preliminary treatment --
    a) Santa Fe and Turkey Creek pumping stations--mechanically cleaned bar screens, grit removal, and chlorination equipment for sulfide control.
    b) West Side Plant--two parallel pre-aeration basins with grit removal by gantry crane from grit-storage pump. Retention time at 113,550 m^3/day (30 mgd) is 45 min. The air available is 750 cm^3 per min./1 per min. (0.1 cfm/gpm) sewage flow.
2. Primary treatment -- Two parallel primary sedimentation basins, each 38.1 m (125 ft) square, equipped with "Squarex" sludge removal equipment for continuous sludge and scum removal.
3. Primary sludge -- Sludge and scum are collected in a scum manhole and pumped to the Blue River WWTP for incineration. The force main is 30.5 cm (12 in.) in dia. and approximately 11 km (7 miles) long. The concentration of sludge pumped is one percent or less.
4. Effluent -- The effluent is discharged via a submerged outfall to the Missouri River (RM 367). The effluent is not disinfected.

Flow is measured with a magnetic flowmeter installed in the influent line. The flow rate is transmitted to a receiver on the plant instrument panel where it is indicated, recorded, and totalized.

C. OPERATION AND MAINTENANCE

The plant is operated and maintained 24 hr/day, 7 days/week by

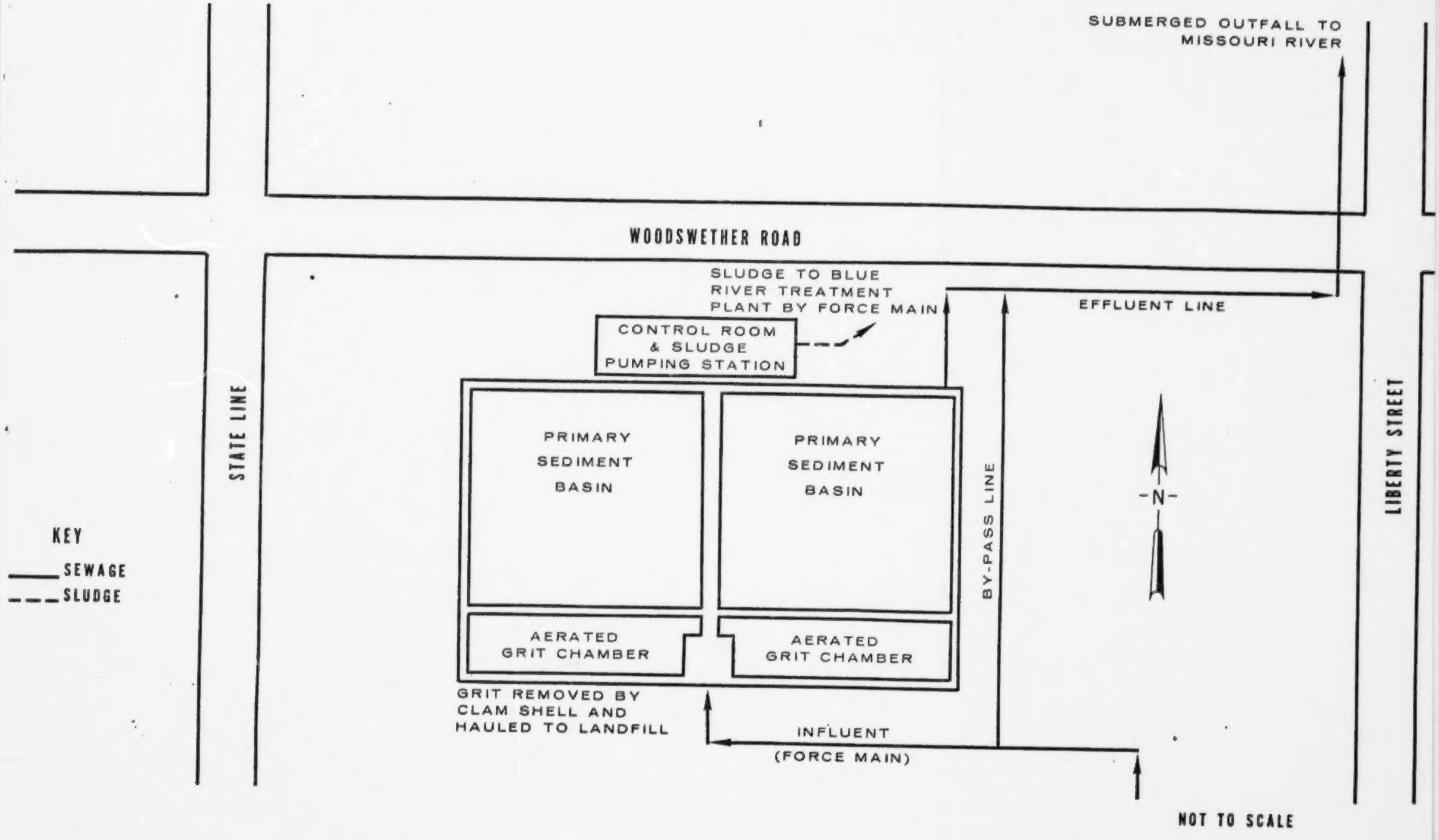
SUBMERGED OUTFALL TO MISSOURI RIVER
WOODSWETHER ROAD
SLUDGE TO BLUE RIVER TREATMENT PLANT BY FORCE MAIN
EFFLUENT LINE
CONTROL ROOM & SLUDGE PUMPING STATION
STATE LINE
LIBERTY STREET
PRIMARY SEDIMENT BASIN
PRIMARY SEDIMENT BASIN
BY-PASS LINE
-N-
KEY
SEWAGE
SLUDGE
AERATED GRIT CHAMBER
AERATED GRIT CHAMBER
GRIT REMOVED BY CLAM SHELL AND HAULED TO LANDFILL
INFLUENT (FORCE MAIN)
NOT TO SCALE

Figure B-8. Kansas City, Missouri West Side Wastewater Treatment Plant

15 employees (9 operators, 1 chief plant operator, and 5 maintenance personnel). They make up three shifts and one relief shift. The crews are responsible for the two pumping stations and the treatment plant. A skeleton crew operates the plant on weekends.

D. TREATMENT PLANT EVALUATION AND FINDINGS

On Friday, September 22, the influent (pre-aerators) and effluent were manually sampled, hourly for 24 hr, and composited on a flow-weighted basis. Similarly, six 24-hr composites of the influent and effluent were collected on September 23 through 28, using SERCO automatic samplers. Grab samples of the influent and effluent were collected once daily for oil-and-grease analysis; one grab sample of the effluent was also collected each day for phenols analysis. Temperature, pH, and conductivity were measured periodically. [Chemical data and field measurements are summarized in Table B-14 through B-16].

The average BOD and suspended-solids loads discharged to the Missouri River were:

	BOD		Suspended Solids	
Date	kg/day	lb/day	kg/day	lb/day
September 22	8,104	17,865	3,472	7,655
September 23-24	1,570	3,460	1,724	3,800
September 25-28	6,486	14,300	4,128	9,100

Removal efficiencies ranged from 33 percent to 52 percent for BOD and from 60 percent to 68 percent for suspended solids. These reductions are consistent with those expected in primary treatment.

Although the plant serves an extensively developed industrial and

TABLE B-14

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
KANSAS CITY, MISSOURI, WEST SIDE WASTEWATER TREATMENT PLANT
SEPTEMBER 22, 1972[a]

Parameter[b]	Influent	Effluent
Flow (m^3/day)	57,910	
Flow (mgd)	15.3	
pH (standard units), range	6.4-8.5	6.3-9.4
Temperature (°C), range	23.5-26	23.5-26
Conductivity (μmhos/cm), range	800-1,060	825-1,000
BOD	210	140
COD	438	265
TOC	92	62
Total Solids	820	683
Suspended Solids	188	60
Volatile Suspended Solids	150	52
Oil & Grease	140	55
Total Phosphorus as P		38
Ortho Phosphate as P		2.2
Total Kjeldahl Nitrogen-N		14.3
NH_3-N		7.7
NO_3 + NO_2-N		0.7
Phenols		
Total Lead	0.24	0.12
Total Zinc	3.65	1.40
Total Copper	0.10	0.061
Total Chromium	0.20	0.12
Total Cadmium	0.05	0.05
Total Mercury (μg/l)	2.4	

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[a] All samples were collected manually.

[b] All values are reported as mg/l, except where specified.

TABLE B-15

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
KANSAS CITY, MISSOURI, WEST SIDE WASTEWATER TREATMENT PLANT
SEPTEMBER 23-24, 1972

Parameter[a/]	Influent	Effluent
Flow (m^3/day)	31,410	
Flow (mgd)	8.3	
pH (standard units), range	7.1-7.4	7.5
Temperature (°C), range	24.5-25	24-25
Conductivity (µmhos/cm), range	800-950	800-1,000
BOD	105	50
COD	285	195
TOC	50	32
Total Solids	700	650
Suspended Solids	136	55
Volatile Suspended Solids	108	43
Oil & Grease	70	30
Total Phosphorus as P		4.1
Ortho Phosphate as P		2.2
Total Kjeldahl Nitrogen-N		10.5
NH_3-N		7.9
NO_3 + NO_2-N		0.3
Phenols		0.9
Total Lead	0.08-0.19	0.07-0.08
Total Zinc	0.41-0.52	0.07-1.3
Total Copper	0.027-0.038	0.018-0.025
Total Chromium	0.10-0.48	0.06-0.09
Total Cadmium	0.03-0.04	0.02-0.03
Total Mercury (µg/l)	1.4-1.6	1.6-4.3

a/ All values are reported as mg/l, except where specified.

TABLE B-16

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA KANSAS CITY, MISSOURI, WEST SIDE WASTEWATER TREATMENT PLANT SEPTEMBER 25-28, 1972

Parameter[a]	Influent	Effluent
Flow (m^3/day)	48,070	
Flow (mgd)	12.7	
pH (standard units), range	6.8-8.4	7.0-7.9
Temperature (°C), range	23.5-26	22.5-26
Conductivity (µmhos/cm), range	540-1,100	750-1,000
BOD	225	135
COD	523	354
TOC	101	64
Total Solids	973	802
Suspended Solids	251	86
Volatile Suspended Solids	205	70
Oil & Grease	29	20
Total Phosphorus as P		4.5
Ortho Phosphate as P		2.6
Total Kjeldahl Nitrogen-N		13.4
NH_3-N		9.5
NO_3 + NO_2-N		0.2
Phenols		0.21
Total Lead	0.25-0.46	0.10-0.48
Total Zinc	1.00-1.84	0.61-1.20
Total Copper	0.082-0.203	0.039-0.103
Total Chromium	0.17-0.19	0.07-0.11
Total Cadmium	0.02-0.04	0.02-0.03
Total Mercury (µg/l)	2.0-4.6	1.6-2.9

[a] All values are reported as mg/l, except where specified.

commercial area, the influent generally had the characteristics of domestic sewage. The highest value of oil and grease reported was on Friday (September 22), indicating that the concentration could be due to sludge discharges from industrial clean-up operations.

E. SUMMARY AND CONCLUSIONS

1. The West Side Wastewater Treatment Plant was operating effectively as a primary facility.

2. Disinfection of the effluent was not provided. The Missouri water-quality criteria for bacteria was violated downstream from the discharge.

F. RECOMMENDATIONS

It is recommended that:

1. Secondary-treatment effluent limitations for publicly owned treatment works established pursuant to the 1972 Amendments be met by December 31, 1975, and that maximum waste loads be predicated on the basis of effluent limitations (e.g. concentration of BOD and suspended solids and present design flow);

2. The BOD and suspended solids in the effluent from the wastewater treatment plants each not exceed a monthly average of 30 mg/l and weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better water quality (this quality of effluent being achievable through a well-operated secondary plant);

3. The fecal-coliform bacterial density in the effluent from the wastewater plants shall not exceed a weekly average of 400/100 ml and a monthly average of 200/100 ml.

B-IV. JOHNSON COUNTY WASTEWATER TREATMENT PLANT
JOHNSON COUNTY, KANSAS

A. GENERAL

Johnson County, Kansas, has four wastewater treatment plants in operation, one under construction, and is expected to take over an existing plant in Lenexa, Kansas. The Main and the Turkey Creek Wastewater Treatment Plants are located adjacent to each other, atop a hill at 5800 Nall Avenue [Figure 1]. Domestic waste (no industrial waste at all) must be pumped up to both plants. The effluent from these plants combine at the bottom of the hill and are discharged to Turkey Creek (RM 367.5/3.4/3.6) upstream of Kansas City, Kansas, Wastewater Treatment Plant No. 5 (RM 367.5/3.4/3.0). The influents and effluents are chlorinated.

Both plants have secondary treatment facilities. The Main plant was placed in operation in 1949; the Turkey Creek plant, in 1962. The Main and Turkey Creek plants are operating at the design capacities of 70,000 and 40,000 population equivalents, respectively.

From September 15 through 17, 1972 EPA personnel conducted an in-plant evaluation. Myron Nelson, chief engineer; Jim Bills, plant superintendent; and Clarence Monday, chief chemist, of the Johnson County Sewer District, provided assistance and information.

B. WASTE TREATMENT FACILITIES

The Main plant has a design flow of 70,020 m^3/day (18.5 mgd) and the Turkey Creek plant, 37,850 m^3/day (10 mgd). The treatment facilities [Figure B-9] include:

1. Main Plant
   a) Preliminary treatment--lift station, chlorination (wet- and dry-weather flows chlorinated up to 10 mg/l), grit removal, and bar screens.
   b) Primary treatment--sedimentation basins with sludge removal systems with two primary and two secondary digesters.
   c) Secondary treatment--two parallel trickling filters followed by intermediate clarification, then by three parallel trickling filters, final clarification, and disinfection. Sludge is either digested or is vacuum filtered and incinerated.
2. Turkey Creek Plant
   a) Preliminary treatment--lift station, chlorination (dry-weather flow), grit removal, and bar screens.
   b) Primary treatment--primary sedimentation basins with sludge-removal systems. Sludge is digested and incinerated at the Main plant.
   c) Secondary treatment--trickling filters, final clarifier, and disinfection.

Flows were measured with recorders in the chlorine-contact chambers at the Main plant and in the lift station for the Turkey Creek plant.

C. OPERATION AND MAINTENANCE

The plants are operated and maintained 24 hr/day, 7 days/week. The staff includes 12 certified operators, four laboratory employees, and maintenance crews.

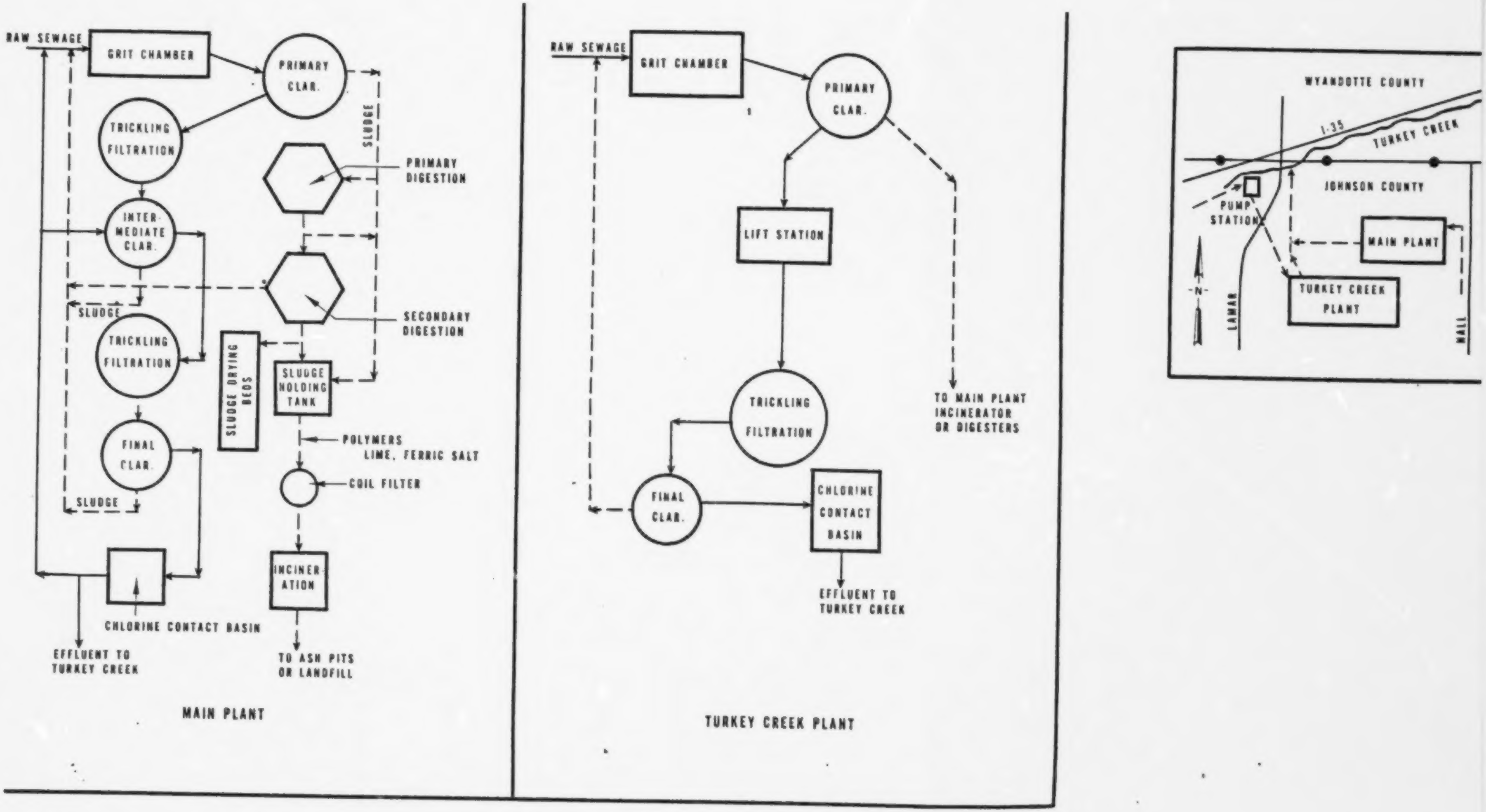
RAW SEWAGE
GRIT CHAMBER
PRIMARY CLAR.
SLUDGE
TRICKLING FILTRATION
PRIMARY DIGESTION
INTER-MEDIATE CLAR.
SECONDARY DIGESTION
SLUDGE
TRICKLING FILTRATION
SLUDGE DRYING BEDS
SLUDGE HOLDING TANK
POLYMERS LIME, FERRIC SALT
FINAL CLAR.
COIL FILTER
SLUDGE
INCINER-ATION
CHLORINE CONTACT BASIN
EFFLUENT TO TURKEY CREEK
TO ASH PITS OR LANDFILL
MAIN PLANT
RAW SEWAGE
GRIT CHAMBER
PRIMARY CLAR.
LIFT STATION
TO MAIN PLANT INCINERATOR OR DIGESTERS
TRICKLING FILTRATION
FINAL CLAR.
CHLORINE CONTACT BASIN
EFFLUENT TO TURKEY CREEK
TURKEY CREEK PLANT
WYANDOTTE COUNTY
I-35
TURKEY CREEK
JOHNSON COUNTY
PUMP STATION
MAIN PLANT
N
TURKEY CREEK PLANT
LAMAR
NALL

Figure B-9. Flow Diagram, Johnson County Wastewater Treatment Plant 5800 Nall

D. TREATMENT PLANT EVALUATIONS AND FINDINGS

The effluents from each plant were sampled for a three-day period that included a weekend. Samples were composited on an equal-volume basis at the end of each 24-hr period. SERCO automatic samplers were used at each location. On September 15 and 16, 4 ml of 0.1N sodium thiosulfate were added to each SERCO bottle to destroy the chlorine residual. On September 17 the sodium thiosulfate was not used. One grab sample was collected daily for oil-and-grease analysis from each effluent. Field measurements for pH, temperature, and conductivity were made periodically. [Chemical data and field measurements are summarized in Tables B-17 and B-18.]

The combined load discharged to Turkey Creek on September 15 and 16 was 1,400 kg (3,100 lb) of BOD/day and 1,040 kg (2,300 lb) of suspended solids/day. On September 17, the day when sodium thiosulfate was not used in the SERCO bottles, the BOD and suspended solids were considerably less. Chlorine oxidizes organic material, thereby reducing the carbonaceous BOD demand. The treatment plant personnel continuously sample effluents from both plants and composite each one on a 24-hr, flow weighted basis. Data obtained from plant personnel on BOD showed average effluent values of 29 mg/l for the Turkey Creek plant and 15 mg/l for the Main WWTP, with ranges of 5 to 70 mg/l and 5 to 47 mg/l, respectively. These ranges are comparable to the data obtained September 15 through 17. Solids data were not made available to EPA personnel.

Although the concentration (log mean) of fecal coliform bacteria in Turkey Creek downstream from the outfalls of the Johnson County

TABLE B-17

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA JOHNSON COUNTY, KANSAS, MAIN WASTEWATER TREATMENT PLANT SEPTEMBER 15-17, 1972

Parameter[a]	Sept. 15-16 Effluent (with sodium thiosulfate)	Sept. 17 Effluent (without sodium thiosulfate)
Flow (m^3/day)	21,950	
Flow (mgd)	5.8	5.8
pH (standard units), range	6.7-6.8	6.7-6.9
Temperature (°C), range	22.5-25	23.5-25.5
Conductivity (μmhos/cm), range	1,000-1,200	900-910
BOD	40	14
COD	378	156
TOC	26	24
Total Solids	1,445	662
Suspended Solids	24	8
Volatile Suspended Solids	12	6
Oil & Grease	15	18
Total Phosphorus as P	12.5	13
Ortho Phosphate as P	11.4	12.2
Total Kjeldahl Nitrogen-N	11.0	8.1
NH_3-N	3.8	2.0
NO_3 + NO_2-N	2.2	2.7

[a] All values are reported as mg/l, except where specified.

TABLE B-18

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
JOHNSON COUNTY, KANSAS, TURKEY CREEK WASTEWATER TREATMENT PLANT
SEPTEMBER 15-17, 1972

Parameter[a]	Sept. 15-16 Effluent (with sodium thiosulfate)	Sept. 17 Effluent (without sodium thiosulfate)
Flow (m^3/day)	13,250	
Flow (mgd)	3.5	3.8
pH (standard units), range	6.7-7.1	7.0
Temperature (°C), range	22-24	24
Conductivity (μmhos/cm), range	975-1,100	860-950
BOD	40	22
COD	360	142
TOC	27	25
Total Solids	1,310	734
Suspended Solids	40	22
Volatile Suspended Solids	22	16
Oil & Grease	24	7
Total Phosphorus as P	12.4	13.7
Ortho Phosphate as P	10.2	13.7
Total Kjeldahl Nitrogen-N	17.7	16.6
NH_3-N	13.7	12.1
NO_3 + NO_2-N	0.5	1.3

[a] All values are reported as mg/l, except where specified.

complex and Kansas City, Kansas, Plant No. 5 was 31,000/100 ml [Table B-5], most of the bacteria was contributed by Plant No. 5 because its effluent was not disinfected. The chlorine residual in the Johnson County effluent ranged from trace amounts to 1.6 mg/l.

E. SUMMARY AND CONCLUSIONS

1. The Main Wastewater Treament Plant and the Turkey Creek Wastewater Treatment Plant produced effluents with BOD and suspended solids concentrations of 32 mg/l and 24 mg/l, respectively. The plants were operated efficiently and were well maintained.

2. Effluents were disinfected; however *Salmonella* was isolated in the chlorine contact basins.

F. RECOMMENDATIONS

It is recommended that:

1. Secondary-treatment effluent limitations for publicly owned treatment works established pursuant to the 1972 Amendments be met by December 31, 1975, and that maximum waste loads be predicated on the basis of effluent limitations (e.g. concentration of BOD and suspended solids and present design flow);

2. The BOD and suspended solids in the effluent from the wastewater treatment plants each not exceed a monthly average of 30 mg/l and weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better water quality (this quality of effluent being achievable through a well-operated secondary plant):

3. The fecal-coliform bacterial density in the effluent from the wastewater plants shall not exceed a weekly average of 400/100 ml and a monthly average of 200/100 ml.

REFERENCES

1. G. N. McDermott. Correspondence to Arthur N. Masse, Environmental Protection Agency, National Field Investigations Center-Denver. Proctor and Gamble Company, Kansas City, Kansas, November 7, 1972.

2. Harold E. Babbitt and E. Robert Baumann, *Sewerage and Sewage Treatment*, John Wiley and Sons, New York, N.Y., 1958.

INDUSTRIAL WASTE SOURCES

This appendix summarizes information concerning industrial waste sources investigated in the Kansas City, Kansas, metropolitan area, September 14 through October 5, 1972.

Eleven industrial plants were evaluated in order to determine water-pollution control practices and waste loads discharged to the Kansas City, Kansas, Kaw Point Wastewater Treatment Plant and to receiving streams via municipal storm and sanitary sewer systems. Included in these industries were three companies that discharge directly to the Missouri River and its tributaries:

Industry	Receiving Stream
Wilson Packing Co.	Kaw Point WWTP
Standard Rendering Co.	Kaw Point WWTP
General American Transportation Corp.	Kaw Point WWTP
Chicago Rock Island Railroad	Kaw Point WWTP
Owens-Corning Fiberglas Corp.	Kaw Point WWTP
Colgate-Palmolive Co.	Kansas River via city sewer
Sims Barrel Co.	Kansas River via city sewer
Acme Plating Corp.	Kansas River via city sewer
PBI-Gordon Corp.	Kansas River
Phillips Petroluem Co.	Missouri River
Penn Central Co.	Turkey Creek

All industrial waste sources were manually sampled by EPA National Field Investigations Center-Denver (NFIC-D) personnel. The Chain-of-Custody procedure [Appendix E] was followed for each sample.

Each industry was requested to grant permission [Appendix F] to allow EPA personnel to sample waste sources and make flow measurements on company property. With one exception, all industries were cooperative and granted the EPA permission to sample on their premises. The

Standard Rendering Company refused to allow EPA personnel on their property. Wastewater samples were obtained from the city manhole where that industrial flow entered the municipal sewer.

The format employed in preparation of the individual evaluation reports was as follows:

A. General -- includes background information and contacts;

B. Waste Sources and Treatment -- includes types of processes, sources of pollution, and waste-treatment practices.

C. Plant Evaluations and Findings -- includes information on evaluation procedure, data from chemical and bacteriological analyses, field measurements, and observations.

D. Summary and Conclusions

E. Recommendations -- waste-treatment requirements that are based on the following criteria:

   1. Compliance with applicable water quality standards;
   2. Compliance with Kansas City, Kansas, Water Pollution Control Ordinance No. 42913;
   3. Waste-load limits achievable by the installation of best practicable control technology currently available.

C-I. WILSON PACKING COMPANY
KANSAS CITY, KANSAS

A. GENERAL

Wilson Packing is the largest cattle- and hog-slaughtering operation in the Kansas City metropolitan area. The company employs 700 people and operates for 24-hr/day, 5 days/week. Slaughtering and processing are done on a 40-hr week basis, the remainder of the time is used for cleanup. At the time of the survey the plant was slaughtering and processing 1,600 cattle and 9,000 hogs per week.

Management decided to eliminate the slaughter of cattle, effective September 30, 1972, because of costs and an overall aesthetic nuisance that had caused problems due to plant location.

From September 19 through 21, 1972, NFIC-D personnel evaluated the waste discharged to the Kansas City, Kansas, municipal sewer system. Plant Manager Victor Stensrud provided information and assistance.

B. WASTE SOURCES AND TREATMENT

Water (4,920 m^3/day or 1.3 mgd) obtained from Kansas City, Kansas, is employed for plant cleaning, processing of carcasses, domestic use, and cooling purposes.

All plant process, cooling, cleaning, and domestic wastewater is discharged to the municipal sewer system for treatment at the Kaw Point WWTP. Pretreatment of wastewater generated in the slaughtering and processing includes:

1. The capture of all blood (dried and sold for protein);
2. Collection of all hair (sold);

3. Hydro-sieving of paunch manure (used as dry fill); and
4. Collecting unmarketable by-products (sold to the Bruce Milling Rendering Company).

The remainder of plant wastewater is discharged without treatment.

Approximately 50 percent of the storm water from plant grounds flows to the Kansas River. The remainder is discharged to the sanitary sewer.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the plant effluent were collected and composited at hourly intervals at the manhole on the southwest corner of the processing plant [Figure C-1]. The samples were composited on an equal-volume basis. One well-mixed grab sample for oil-and-grease analyses was collected daily. Temperature, pH, and conductivity were measured each time a sample was collected. Flows were obtained from the plant manager. [Chemical data and field measurements are summarized in Table C-1].

The daily waste load discharged to the municipal sewer averages 5,900 kg (13,000 lb) BOD (8.0 kg/500 kg or 16.1 lb/1,000 lb LWK*) and 6,900 kg (15,200 lb) suspended solids (9.4 kg/500 kg or 18.8 lb/1,000 lb LWK). The quantity of oil and grease ranged from 1,000 to 2,300 mg/l. Because sampling for oil-and-grease determination was done on a grab basis, the samples could have been taken during periods of slug discharges. However, the time of sampling was varied each day (2 PM,

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* Live Weight Kill is based on company figures: average hog weight, 119 kg (262 lb); average cow weight, 475 kg (1,047 lb).

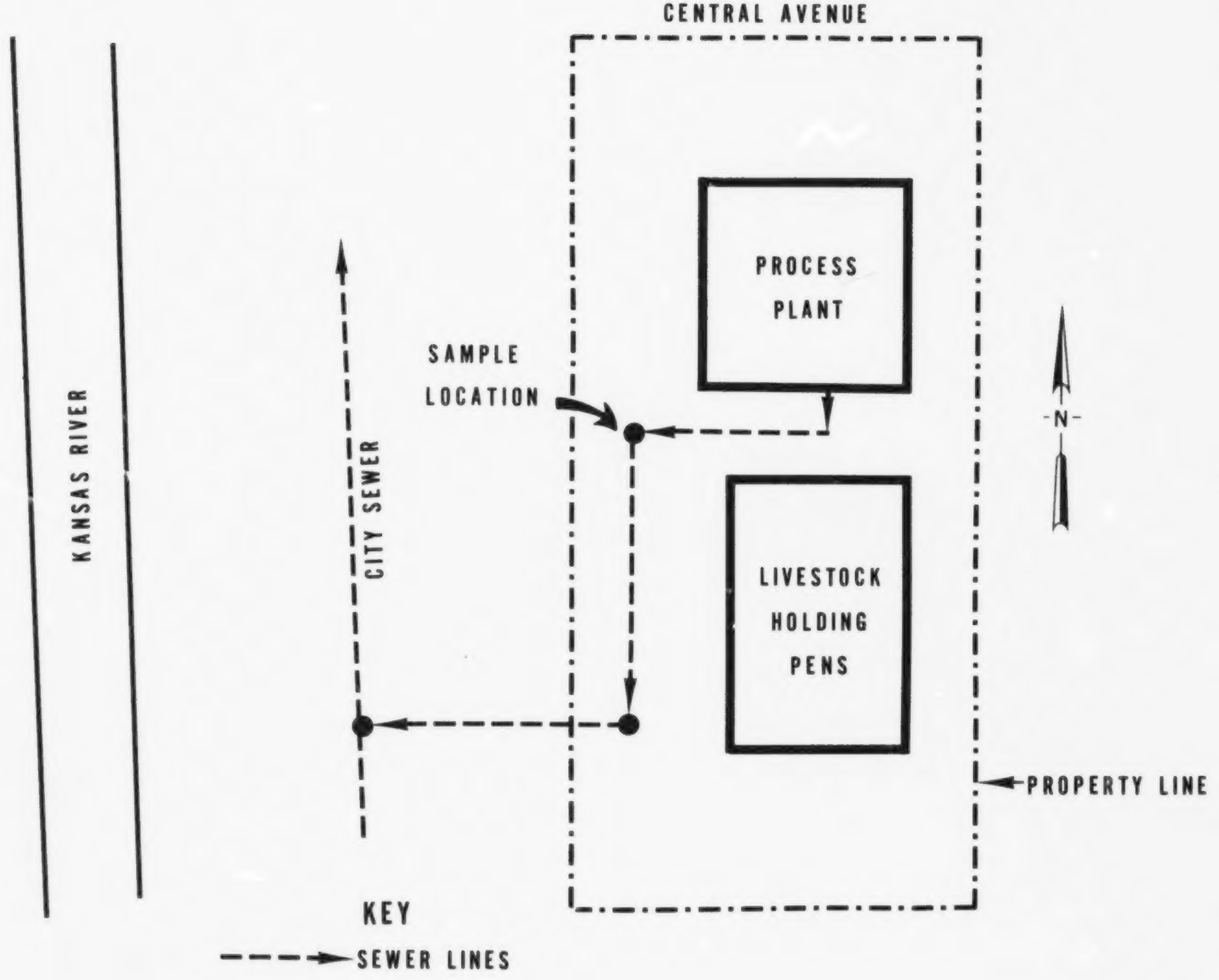
CENTRAL AVENUE
PROCESS PLANT
LIVESTOCK HOLDING PENS
-N-
SAMPLE LOCATION
PROPERTY LINE
CITY SEWER
KANSAS RIVER
KEY
SEWER LINES

Figure C-1. Wilson Packing Company

TABLE C-1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
WILSON PACKING CO., KANSAS CITY, KANSAS
SEPTEMBER 19-21, 1972

Parameter[a]	EFFLUENT			
	Sept. 19	Sept. 20	Sept. 21	Average
Flow (m^3/day)	4,730	4,920	5,110	4,920
Flow (mgd)	1.25	1.30	1.35	1.30
pH (standard units), range	6.8-7.1	6.3-8.1	6.4-8.8	6.3-8.8
Temperature (°C), range	32.0-37.0	29.5-36.0	31.5-36.0	29.5-37.0
Conductivity (μmhos/cm), range	1,200-4,500	1,000->8,000	1,000-7,000	1,000->8,000
BOD	1,200	1,400	1,100	1,200
COD	3,140	5,250	2,650	3,680
TOC	520	900	510	640
Total Solids	5,740	3,770	2,370	3,960
Suspended Solids	1,570	1,580	1,100	1,400
Volatile Suspended Solids	1,320	1,340	880	1,180
Oil & Grease	1,000	2,300	2,000	1,800

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[a] All values reported as mg/l, except where specified.

3 PM, and 4PM), and the concentrations remained high. If the oil-and-grease concentrations were typical, the estimated load discharged to the Kaw Point WWTP could be as much as 4,540 kg/day (10,000 lb/day) (based on 8 hr of kill, 4 hr of clean up).

Effluent limitations for direct discharge to a navigable stream have been proposed for this industry based on "best practicable" treatment, plant capacity, and receiving water requirements. These loads are 0.07 kg BOD/500 kg LWK (0.14 lb/1,000 lb) and 0.05 kg suspended solids/500 kg LWK (0.1 lb/1,000 lb).

D. SUMMARY AND CONCLUSIONS

1. The Wilson Packing Company discharged wastes, to the Kaw Point WWTP, containing 1,200 mg/l BOD (8.0 kg/500 kg or 16.1 lb/1,000 lb LWK), 1,400 mg/l suspended solids (9.4 kg/500 kg or 18.8 lb/1,000 lb LWK); the concentration of oil and grease ranged from 1,000 to 2,300 mg/l.

2. Pretreatment included the recovery of blood, hair, paunch manure, and unmarketable by-products. However, the waste load discharged contributes to the high-strength waste received at the Kaw Point WWTP, and additional pretreatment is required to reduce the BOD, suspended solids, and oil and grease.

E. RECOMMENDATIONS

It is recommended that pretreatment regulations be established for Wilson Packing Company requiring the removal of pollutants to levels that will not inhibit treatment of the combined wastes by biological treatment processes or pass through the publicly owned treatment systems in concentrations or loads inconsistant with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

C-II. STANDARD RENDERING COMPANY
KANSAS CITY, KANSAS

A. GENERAL

Standard Rendering produces tallow, oil, and greases from edible and unedible scraps collected from packing plants in the metropolitan area. The plant operates 24 hr/day, 5 days/week, and 12 hr on Saturdays; there are 24 employees. The rendering plant operates on a batch basis and has a rated capacity of 1.25 million lb of scraps/week. A new, continuously operating plant is scheduled to be built in 1973 on adjacent property; at that time the old plant will be removed.

The parent company, Darling-Delaware Rendering, refused to allow NFIC-D personnel on the premises for the purpose of collecting waste samples or measuring flow. A. E. Millis, manager of Standard Rendering, provided information to NFIC-D personnel concerning operations.

On September 19 through 21, 1972, the waste load discharged to the municipal sewer system was evaluated by NFIC-D personnel. The waste was sampled at the manhole on Shawnee Street, a public thoroughfare [Figure C-2], where the Standard Rendering effluent empties into the City sewer. Flows were obtained from Mr. Millis.

B. WASTE SOURCES AND TREATMENT

Thirty-four hundred m^3/months (900,000 gal./month), as estimated by Mr. Millis, of well water and 3,320 m^3/month (878,000 gal./month) of municipal water are used for boilers, sanitary purposes, and steam makeup.

The plant has nine cookers for scraps and one cooker for grease, each with a capacity of approximately 3,200 kg (7,000 lb). Scraps and grease are cooked at atmospheric pressure. In order to prevent grease from returning to the boilers the steam generated in them is wasted instead of being recycled.

Most of the wastewater is generated in the wash-rack area and clean-up operation. All wash water from the plant goes to a baffled catch basin (5.5 m x 1.82 m x 1.22 m deep or 18 x 6 x 4 ft) where grease is removed manually in the morning hours. The grease is returned to the grease cooker; the effluent from the catch basin flows to the city sewer. After the grease has been removed, a plug is removed from the basin, and the entire contents are drained to the city sewer and the Kaw Point WWTP. Several times a year the Armourdale pumping station becomes clogged with fats and grease.

Paunch manure, rags, and solids are hauled to a landfill three times a week. There are no storm drains or storm sewers on the property.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the effluent were taken hourly and composited on an equal-volume basis. A well-mixed grab sample for oil-and-grease analysis was collected each day. Temperature, pH, and conductivity were measured each time a sample was collected. [Chemical data and field measurements are summarized in Table C-2.]

The average flow reported was 307 m^3/day (81,000 gpd); however, the 25.4 cm (10-in.) diameter pipe was observed flowing full every time

C-10-A

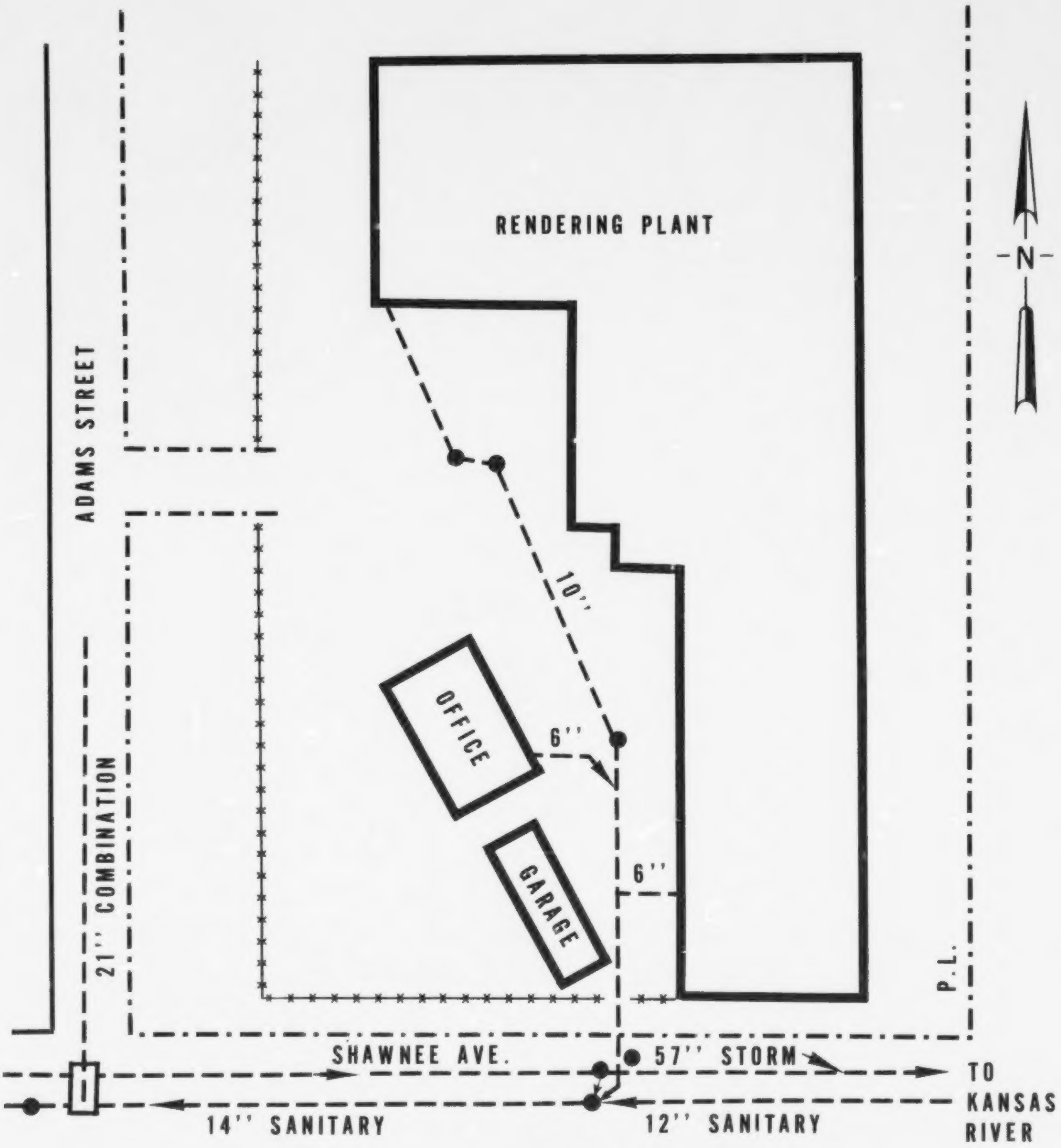
RENDERING PLANT
N
ADAMS STREET
10''
OFFICE
6''
GARAGE
6''
21'' COMBINATION
P.L.
SHAWNEE AVE.
57'' STORM
TO KANSAS RIVER
14'' SANITARY
12'' SANITARY

Figure C-2. Standard Rendering Company

TABLE C-2

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL DATA
STANDARD RENDERING COMPANY, KANSAS CITY, KANSAS
SEPTEMBER 19-21, 1972

Parameter[a]	EFFLUENT			
	Sept. 19	Sept. 20	Sept. 21	Average
Flow (m^3/day)				5,680[b]
Flow (mgd)				1.5[b]
pH (standard units), range	6.5-7.6	6.6-7.7	6.6-8.6	6.5-8.6
Temperature (°C), range	28.0-44.0	25.0-60.0	22.0-48.0	22.0-60.0
Conductivity (µmhos/cm), range	1,700-4,500	1,600-3,000	2,000-3,500	1,600-4,500
BOD	1,000	700	600	800
COD	3,580	2,350	1,140	2,360
TOC	760	340	240	450
Total Solids	2,420	2,020	1,860	2,100
Suspended Solids	700	380	216	430
Volatile Suspended Solids	646	324	184	385
Oil & Grease[c]		1,600	580	930

---

a/ All values are reported as mg/l, except where specified.

b/ This is a calculated flow value; company reports an average of 307 m^3/day (0.081 mgd).

c/ The September 22 sample yielded 600 mg/l of oil and grease.

samples were collected, thus indicating a much higher flow, about 5,680 m^3/day (1.5 mgd).* The variance in flow may be caused by not measuring the well water used.

On the basis of the calculated flow the BOD and suspended solids discharged to the Kaw Point WWTP were 4,540 kg/day (10,000 lb/day) and 2,450 kg/day (5,400 lb/day) respectively. The amount of oil and grease discharged ranged from 590 to 1,600 mg/l.

D. SUMMARY AND CONCLUSIONS

1. The Standard Rendering Company discharged high amounts of BOD, suspended solids, and oil and grease to the city sewer and Kaw Point WWTP. The oil and grease has caused problems in the city pump station and could damage equipment at the treatment plant. The BOD and suspended solids contributed to the high values reported in the influent to the Kaw Point plant.

2. Observations revealed that the effluent pipe was flowing full each time samples were collected. The flow reported by the company was (303 m^3/day or 0.08 mgd); whereas calculations indicate aa flow of 5,680 m^3/day (1.5 mgd). The difference in the flows could be due to the unmetered well water used in the plant.

E. RECOMMENDATIONS

It is recommended that pretreatment regulations be established for Standard Rendering Company requiring the removal of pollutants to levels that will not inhibit treatment of the combined wastes by biological treatment processes or pass through the public systems in concentrations or loads inconsistant with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

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* This is a calculated flow; it was obtained using the Darcy-Weisbach equation and from blueprints of the profile of the company sewer.

C-III. GENERAL AMERICAN TRANSPORTATION CORPORATION
KANSAS CITY, KANSAS

A. GENERAL

The General American Transportation Corporation (GATX) leases railroad transportation cars. The facility at Kansas City, Kansas, repairs tank and freight cars and hydrostatically tests tank cars previously cleaned on the site. Approximately 12 cars can be repaired and cleaned each day. The plant employs 110 people and operates 8 hr/day, 5 days/week.

On September 26 through 28, 1972, NFIC-D personnel made an in-plant survey. Robert Mercer, plant manager, and Joe Arcurie, assistant general superintendent, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

All water used by GATX is supplied by the City, at a rate of approximately 284 m^3/day (75,000 gal./day). In order to reduce consumption water re-use is practiced where ever possible.

There are three direct discharges to the Santa Fe Ditch, which flows to the Kansas River [Figure C-3]. Two of these discharges contain storm water, and the third discharge contains clean water from the hydrostatic testing area, compressor cooling water, boiler blowdown, and storm-water drainage. An application for discharge under the Refuse Act Permit Program has been filed with the U. S. Army Corps of Engineers for the three outfalls.

Residue from the cleaned tank cars is pretreated before being discharged into the Kansas City, Kansas, sewer system. This residue is conveyed by flumes to two holding basins (each, 190 m^3 or 50,000-gal.

capacity) equipped with surface skimmers and sludge removal equipment. Skimmed oil and bottom sludge are hauled to a landfill. The effluent from the holding basins is treated with lime or acid (concentrated sulfuric) to adjust the pH to 7; alum is added as a flocculant. The waste stream then flows to an Infilco ACCELATOR upflow flotation unit for solids removal. The solids, manually removed by turning a valve, flow back to the holding basins. The effluent from the flotation unit is discharged to the city sewer. The treatment plant is continually manned and operates only during work hours. A pH monitor on the discharge end of the plant records the effluent pH; lime or acid is automatically added to the ACCELATOR influent, as required, in order to maintain the effluent at pH 7.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the effluent (from the ACCELATOR) -- discharged to the city sewer, were collected and composited on an equal-volume basis. A well-mixed grab sample, for analysis of oil and grease, and a grab sample, for analysis of phenols, were collected daily. Temperature, pH, and conductivity were measured each time a sample was collected. Flows were obtained from the treatment-plant flow totalizer. [Chemical data and field measurements are summarized in Tables C-3 and 4.]

The normal flow rate for the treatment system is 60.5 m^3/day (16,000 gpd). On two of the three days, flow was less than normal. The COD of the effluent was 7,880 mg/1, and the suspended solids were

C-16. A

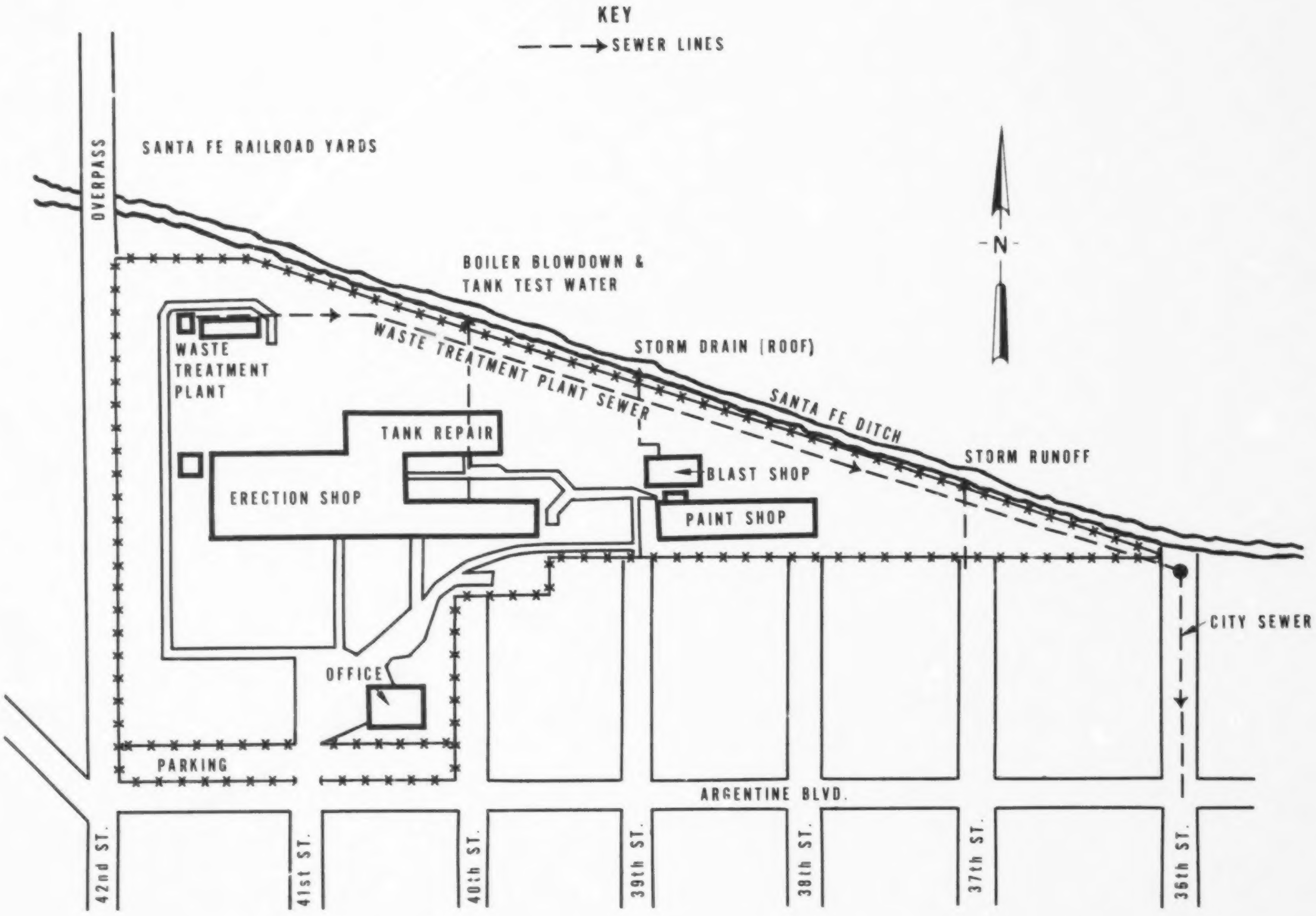
KEY
SEWER LINES
OVERPASS
SANTA FE RAILROAD YARDS
N
BOILER BLOWDOWN & TANK TEST WATER
WASTE TREATMENT PLANT
WASTE TREATMENT PLANT SEWER
STORM DRAIN (ROOF)
SANTA FE DITCH
STORM RUNOFF
TANK REPAIR
ERECTION SHOP
BLAST SHOP
PAINT SHOP
OFFICE
CITY SEWER
PARKING
ARGENTINE BLVD.
42nd ST.
41st ST.
40th ST.
39th ST.
38th ST.
37th ST.
36th ST.

Figure C-3. General American Transportation Corporation

TABLE C-3

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
GENERAL AMERICAN TRANSPORTATION CORP., KANSAS CITY, KANSAS
SEPTEMBER 26-28, 1972

Parameter[a/]	EFFLUENT			
	Sept. 26	Sept. 27	Sept. 28	Average
Flow (m^3/day)	62	43.5	50.0	51.9
Flow (gpd)	16,380	11,480	13,220	13,700
pH (standard units), range	6.6-9.0	6.3-7.1	6.7-9.5	6.3-9.5
Temperature (°C), range	25.5-28.0	26.0-28.5	26.5-28.0	25.5-28.5
Conductivity (µmhos/cm), range	6,000-7,000	6,000	5,000-6,000	5,000-7,000
COD	8,760	8,870	5,920	7,880
TOC	1,600	2,300	1,800	1,860
Total Solids	6,180	4,340		5,420
Suspended Solids	3,370	1,790		2,720
Volatile Suspended Solids	2,220	1,260		1,820
Oil & Grease	1,100	670	350	700
Phenols		4.8	5.0	4.9
Total Lead	0.48	0.26	0.38	0.39
Total Zinc	2.90	1.96	1.60	2.22
Total Copper	0.298	0.166	0.222	0.24
Total Chromium	0.24	0.12	0.17	0.18
Total Cadmium	0.03	0.03	0.03	0.03
Total Mercury (µg/l)	3.1	1.7	2.8	2.6

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a/ All values are reported as mg/l, except where specified.

TABLE C-4

ORGANIC COMPOUNDS PRESENT IN ACCELATOR EFFLUENT
GENERAL AMERICAN TRANSPORTATION CORP., KANSAS CITY, KANSAS
SEPTEMBER 27-28, 1972

Parameter	Effluent Concentration, μg/l Sept. 27	Effluent Concentration, μg/l Sept. 28
Napthalene	2,500	2,800
1-Methyl napthalene	1,400	900
2-Methyl napthalene	1,800	1,900
Phenanthrene	1,100	1,300
Acenapthene	400	300
3,4-Dichloroaniline	14,000	12,500
2,5-Dichloroaniline	3,200	3,100
n-Dodecane	2,500	3,000
n-Tridecane	3,500	3,500
n-Decane	1,000	1,500
n-Hendecane	2,000	2,500
n-Tetradecane	3,500	4,000
n-Pentadecane	3,000	4,000
n-Hexadecane	2,000	2,000
n-Heptadecane	500	500
Pentachlorophenol	14,000	

approximately 2,720 mg/l. The oil-and-grease concentration ranged from 350 to 1,100 mg/l. Similar treatment units have produced effluent concentrations of oil and grease of 20 mg/l or less.

Some of the organic compounds [Table C-4] were present in high concentrations, notably dichloroanilines (17 mg/l) and pentachlorophenol (14 mg/l). These compounds are toxic and could effect the efficiency of biological treatment processes.

D. SUMMARY AND CONCLUSIONS

1. The GATX Corporation cleans railroad tank cars that contained petroleum products and chemicals. The residue from the cleaning operation was pretreated before being discharged to the municipal sewer system. The effluent from the pretreatment facility had concentrations of suspended solids, oil and grease, and COD of 2,700 mg/l, 700 mg/l, and 7,880 mg/l, respectively. The pretreatment facility was not operating efficiently.

2. Some of the organic compounds present could adversely affect biological treatment processes.

E. RECOMMENDATIONS

It is recommended that pretreatment regulations be established for the GATX Corporation requiring the removal of toxic substances and pollutants to levels which will not inhibit biological treatment or pass through the public systems in concentrations or loads inconsistant with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

C-IV. CHICAGO ROCK ISLAND RAILROAD
KANSAS CITY, KANSAS

A. GENERAL

Operations at the Rock Island Railroad terminal yard include locomotive and railroad-car repair, maintenance, cleaning, fueling, painting, and classification. The operation is continuous, 7 days/week, 24 hr/day. About 250 people are employed in the yard and shops. The shop repairs and maintains 18 diesel locomotives a day.

From September 26 through 28, 1972, NFIC-D personnel conducted an in-plant survey to determine the characteristics and volume of waste discharged to the municipal sewer and Kaw Point WWTP. Warren Taylor, engineer for Rock Island, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

All water employed in the operations is purchased from the City and is used for washing, servicing, sanitary, air conditioning, and steam production.

Industrial wastes are generated in the washing and fueling areas, maintenance and repair shops, and from storm run-off that contains oils, fuels, and lubricants spilled on the grounds. These industrial wastes are treated in an oil-recovery system before being discharged to the 12th Street sewer [Figure C-4]. According to the director of the Kansas City, Kansas, Water Pollution Control Department, the waste is intercepted at 12th Street and Kansas Avenue and flows to the Kaw Point WWTP. When the wet-weather flow exceeds the dry-weather flow by a factor of three, storm water is diverted from the oil-recovery plant to the 12th Street sewer.

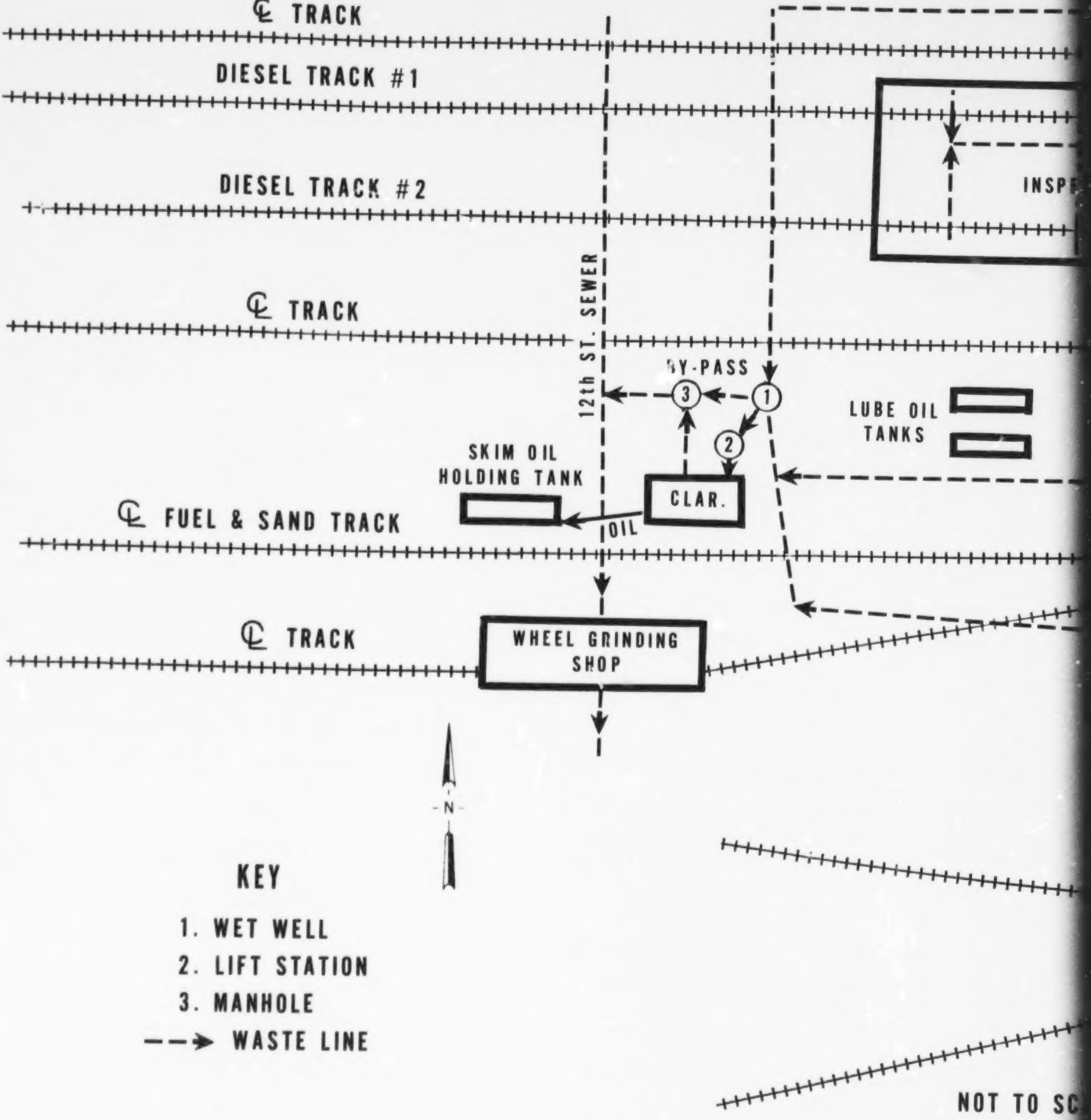
The Rock Island industrial-waste treatment plant is composed of a wet well, two Clow Air-O-Flo Air Ejection System pumps, and an API separator equipped with a Walker Process oil skimmer and bottom scraper system. Recovered oil is pumped to a holding tank and periodically hauled away by a commercial contractor. The effluent from the separator flows to a second wet well and then to the municipal sewer.

Spilled chromate cooling water, used in the locomotive engines, flows to the treatment system, but is not removed.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the API-separator effluent were collected hourly and composited on an equal volume basis. A well-mixed grab sample, for oil-and-grease analysis, and a grab sample for determination of phenols were collected daily. Temperature, pH, and conductivity were measured each time a sample was collected. Mechanical recorders were attached to the counter-weight arms on the ejector pumps. Each time an ejector was activated, the counter-weight arm would trip the mechanical recorder. An ejector pumped 945 liters (250 gal.) each time it was activated. Flows were determined from the total number of times the ejectors were activated. [Chemical data and field measurements are summarized in Table C-5.]

During 1971, 418 m^3 (110,400 gal.) of oil were recovered in the API separator. In March 1972 the Walker Process skimmer-and-sludge scraper was placed into operation, but figures were not available to determine whether the oil recovery had improved. The separator effluent had an average oil concentration of 430 mg/l. Because detergents flowed


℄ TRACK
DIESEL TRACK #1
DIESEL TRACK #2
INSPE
12th ST. SEWER
℄ TRACK
BY-PASS
3
1
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LUBE OIL TANKS
SKIM OIL HOLDING TANK
CLAR.
OIL
℄ FUEL & SAND TRACK
℄ TRACK
WHEEL GRINDING SHOP
N
KEY
1. WET WELL
2. LIFT STATION
3. MANHOLE
- - -➤ WASTE LINE
NOT TO SC

Figure C-4. Rock Island Railroad Waste T

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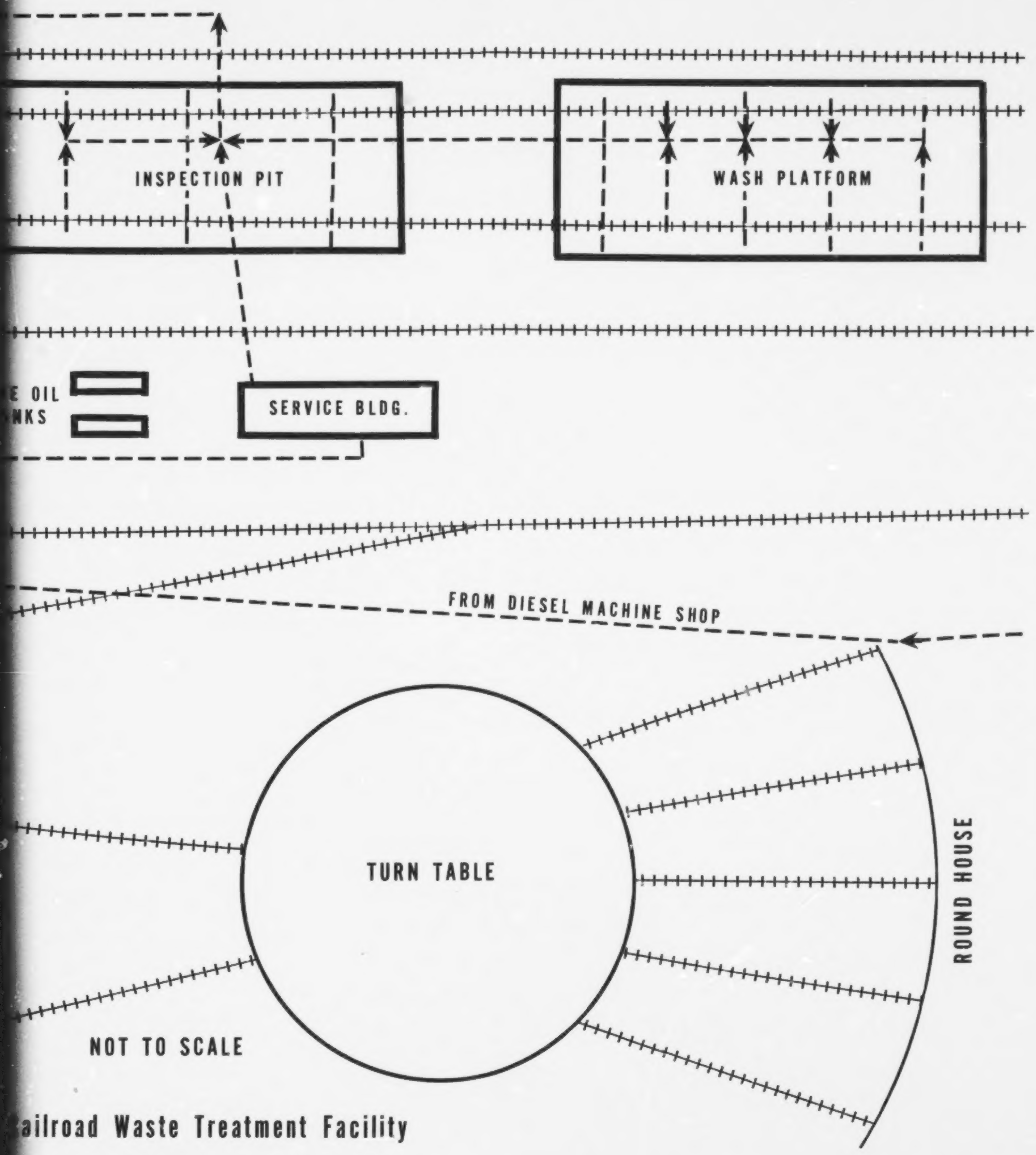
INSPECTION PIT
WASH PLATFORM
E OIL
NKS
SERVICE BLDG.
FROM DIESEL MACHINE SHOP
TURN TABLE
ROUND HOUSE
NOT TO SCALE

ailroad Waste Treatment Facility

C-22-A

TABLE C-5

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
ROCK ISLAND RAILROAD, KANSAS CITY, KANSAS
SEPTEMBER 26-28, 1972

Parameter[a]	EFFLUENT Sept. 26	Sept. 27	Sept. 28	Average
Flow (m^3/day)	162.8	128.7	75.7	121.2
Flow (mgd)	0.043	0.034	0.020	0.032
pH (standard units), range	7.6-10.3	9.0-10.5	8.1-9.2	7.6-10.5
Temperature (°C), range	27.0-36.0	25.0-34.5	27.0-38.0	25.0-38.0
Conductivity (μmhos/cm), range	2,500-6,000	1,150-6,000	950-3,100	950-6,000
COD	2,380	2,420	1,550	2,220
TOC	470	450	310	430
Total Solids	2,100	2,530	1,260	2,500
Suspended Solids	330	184	98	231
Volatile Suspended Solids	258	164	82	189
Oil & Grease		[b]	620	430
Phenols[c]		2.2	1.8	1.6
Total Lead	0.48	0.18	0.21	0.32
Total Zinc	0.33	0.20	0.16	0.25
Total Copper	0.305	0.140	0.080	0.20
Total Chromium	0.63	0.87	1.52	0.90
Total Cadmium	0.04	0.02	0.01	0.03
Total Mercury (μg/l)	0.9	1.3	0.3	0.9

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a/ All values are reported as mg/l, except where specified.
b/ Grab sample at 0600 hours yielded 440 mg/l: Grab sample at 1005 hours yielded 220 mg/l.
c/ On September 29 the value was 0.7 mg/l.

through the separator, much of the oil remained emulsified and was not removed. The detergents, used in the cleaning operation, have a high pH to aid in emulsifying oils (the pH of the effluent ranging from 7.6 to 10.5).

The average COD of the effluent was 2,220 mg/l, thus indicating a high organic content, probably due to fuels, oils, and solvents used in the operation. The concentration of total chromium was 0.9 mg/l and phenols averaged 1.6 mg/l.

D. SUMMARY AND CONCLUSIONS

1. The Chicago Rock Island Railroad pretreatment facility discharged an average of 430 mg/l of oil and grease to the Kaw Point WWTP. Because detergents are used in car-cleaning operations and flow through the separator, the oil-and-grease remains emulsified. The facilities do not adequately treat the wastes.

2. Fuels, solvents, and oils in the effluent contributed to a high organic content (COD = 2,220 mg/l).

3. The pH ranged from 7.6 to 10.5. This condition violated the Kansas City, Kansas, Ordinance No. 42913 which prohibits the discharge of any waste with a pH lower than 5.0 or higher than 10.0 to the city sewer.

E. RECOMMENDATIONS

It is recommended that:

1. Pretreatment regulations be established for Chicago Rock Island Railroad requiring that removal of toxic substances and pollutants to levels which will not inhibit biological treatment processes or pass

through the public systems in concentrations or loads inconsistent with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

2. The Chicago Rock Island Railroad neutralize the pH of the effluent in order to comply with the City Ordinance limitations.

C-V. OWENS-CORNING FIBERGLAS CORPORATION
KANSAS CITY, KANSAS

A. GENERAL

Owens-Corning produces approximately 396 metric tons/day (874,000 lb/day) of glass fibers for home and industrial insulating and construction products. Approximately 254 metric tons/day (280 tons/day) of sand, dredged from the Kansas River, is mixed with other ingredients and melted to form the glass fibers. The plant operates three shifts, 7 days/week, and employs 1,200 people.

NFIC-D personnel conducted an in-plant survey, October 3 through 5, 1972, to determine the waste characteristics and flows discharged to the Kaw Point WWTP. William C. Brunker, environmental superintendent, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

The plant has four wells that furnish 7,570 m^3/day (2 mgd) of water. An additional 114 m^3/day (30,000 gpd) is purchased from the City. Most of the water is used in the once-through cooling process and is discharged to the Fairfax Cooling Water Diversion Sewer which empties into the Missouri River. Storm water is also discharged to this sewer. (A Refuse Act Permit Program Application was filed for this discharge.)

The plant has been actively involved in a water conservation and recycle program. Cullet water (fractured glass) is recycled; storm and sanitary wastes (including industrial waste) have been separated. All industrial wastewater is scheduled to be recycled by September 1975.

In addition, the once-through cooling system is to be replaced by a recirculating system by January 1, 1974.

The main waste problem originates in the chain-washing process. The "chain" is a continuous belt screen on which the glass fiber is caught and deposited as a blanket. A resin, a phenolic compound, is sprayed on the fiber, before deposition but after attenuation, by flame or steam. The chain is washed after removal of the fiber blanket in order to remove resin and glass-fiber particles and thus, prevent clogging of the chain.

Industrial waste is discharged to the municipal sewer system on Sunshine and Fiberglass Roads [Figure C-5]. The only pretreatment provided is screening to remove solids which are subsequently hauled to a landfill. To remove fibers each of the seven production lines have two Ty-Rocke shakers (one used as a standby). The wastewater is re-screened in the plant sewers just before being discharged to the municipal system.

EPA interim Effluent Guidelines developed for the Glass Fiber Industry allow the discharge of wastewater from the manufacturing process only to a municipal treatment plant with acceptable secondary or higher treatment and the ability to handle the process load.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the effluents to Sunshine Avenue and Fiberglass Road were taken at hourly intervals and composited on an equal-volume basis. A grab sample for phenols analysis was collected daily from each effluent. One well-mixed sample for determination of oil and grease was collected from the Fiberglass Road effluent. Temperature, pH, and conductivity

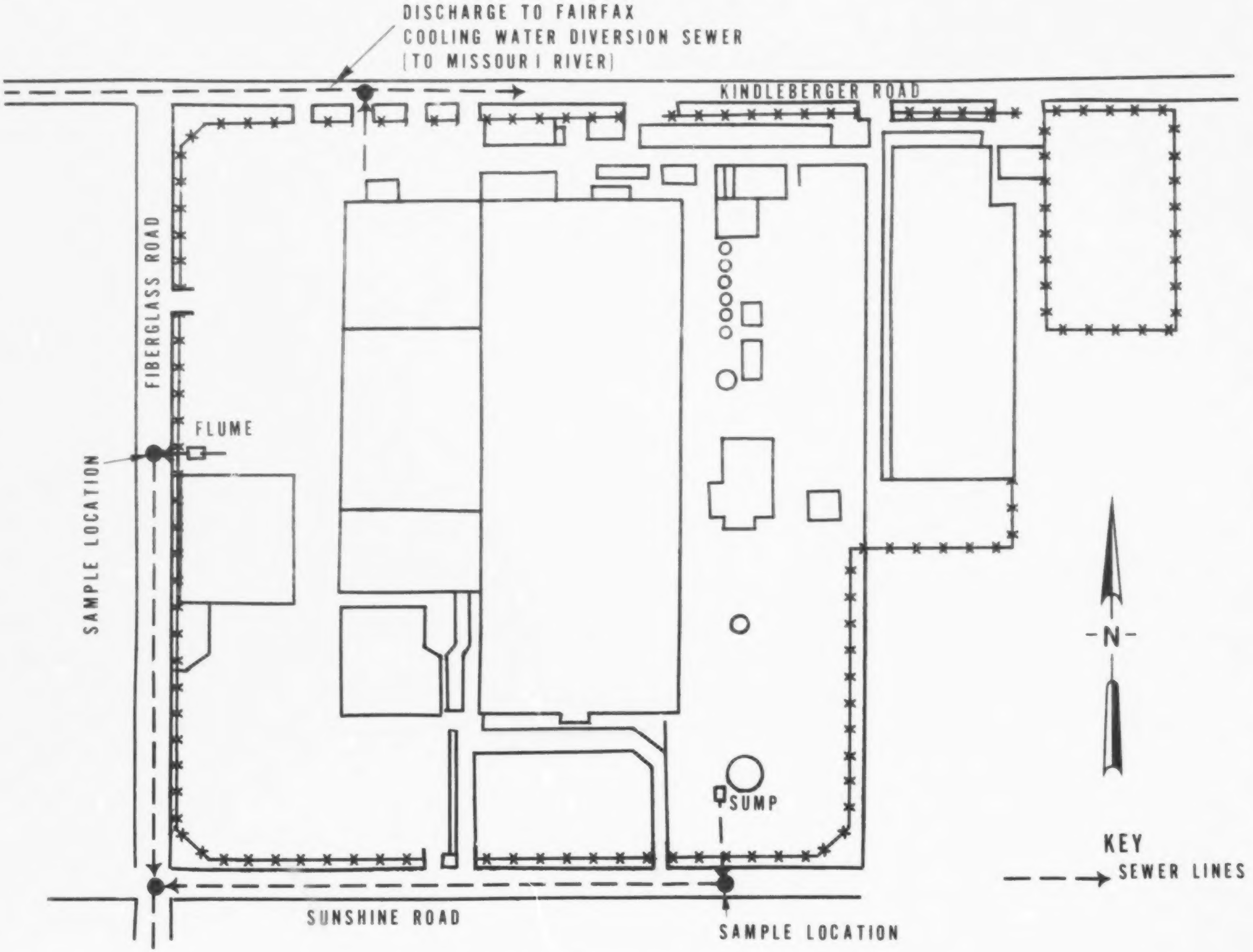
DISCHARGE TO FAIRFAX
COOLING WATER DIVERSION SEWER
(TO MISSOURI RIVER)
KINDLEBERGER ROAD
FIBERGLASS ROAD
FLUME
SAMPLE LOCATION
N
SUMP
KEY
SEWER LINES
SUNSHINE ROAD
SAMPLE LOCATION

Figure C-5. Owens-Corning Fiberglas

were measured each time a sample was collected. Flows were obtained from company flow totalizers on each discharge line. The flow to Fiberglass Road was measured in a 22.9-cm (9 in.) Parshall flume with a recorder while the flow to Sunshine Avenue was measured with a 22.9-cm (9 in.) magnetic flow meter. [Chemical data and field measurements are summarized in Table C-6.]

The combined waste load discharged to the Kaw Point WWTP was 2,377 kg BOD/day (5,240 lb) and 1,833 kg suspended solids/day (4,040 lb); the concentration of phenols ranged from 20 to 64 mg/l. The pH of the Fiberglass Road effluent ranged from 6.1 to 12.2.

D. SUMMARY AND CONCLUSIONS

1. The waste discharged to the municipal sewer contributed approximately six percent of the BOD and three percent of the suspended solids reported in the influent to the Kaw Point WWTP. This waste load will be eliminated by September 1975 when all wastewater will be recycled. Additional treatment is required to reduce the concentration of BOD and solids discharged.

2. Concentrations of phenols ranged from 20 to 64 mg/l. Phenols are not removed in the Kaw Point WWTP.

3. The Fiberglass Road effluent had a pH range of 6.1 to 12.2, the upper range of which violated the Kansas City, Kansas, Ordinance No. 42913 that prohibits the discharge of any waste with a pH lower than 5.0 or higher than 10.0.

TABLE C-6

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
OWENS-CORNING FIBERGLAS CORP., KANSAS CITY, KANSAS
OCTOBER 3-5, 1972

Parameter[a]	Sunshine Ave. Effluent	Fiberglass Road Effluent
Flow (m^3/day)	1,306	1,363
Flow (mgd)	0.345	0.360
pH (standard units), range	7.4-8.7	6.1-12.2
Temperature (°C), range	12.0-35.5	18.0-29.0
Conductivity (μmhos/cm), range	900-8,000	500-15,000
BOD	1,300	500
COD	4,670	1,910
TOC	1,400	360
Total Solids	3,990	1,570
Suspended Solids	1,130	264
Volatile Suspended Solids	680	175
Oil & Grease		140[b]
Phenols, range	28-98	11-35

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[a] All values are reported as mg/l, except where specified.

[b] This figure is based on one value.

E. RECOMMENDATIONS

It is recommended that:

1. Pretreatment regulations be established for the Owens-Corning Fiberglas firm requiring the removal of toxic substances and pollutants to levels that will not inhibit biological treatment or pass through the public systems in concentrations or loads inconsistent with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

2. The Owens-Corning Fiberglas Corporation neutralize the pH of the effluent to comply with the limitations of the City Ordinance.

C-VI. COLGATE-PALMOLIVE COMPANY
KANSAS CITY, KANSAS

A. GENERAL

Colgate-Palmolive produces varied amounts of soap, detergents, glycerine, cosmetics, and other toilet preparations. Soap is produced by the batch-kettle method. Powdered detergents are batch mixed and processed through continuous spray drying towers. Liquid detergents and toilet articles are produced by batch mixing systems. Glycerine is produced by evaporation and distillation.

The plant operates 24 hr/day, 7 days/week, and employs 650 people.

From September 19 through 21, 1972, NFIC-D personnel conducted an in-plant survey. R. L. Swinney, plant manager, and E. B. Nease, soap and process manager, provided assistance and information.

B. WASTE SOURCES AND TREATMENT

Colgate-Palmolive uses municipal water (approx. 1,855 m^3/day or 0.49 mgd) and ground water (4,010 m^3/day or 1.06 mgd). About 4,540 m^3/day (1.2 mgd) are used for cooling, 680 m^3/day (0.18 mgd) for processes water, 455 m^3/day (0.12 mgd) for boiler feed water, and 230 m^3/day (0.06 mgd) used for sanitary purposes (values based on yearly consumption figures).

A portion of the water is chemically softened and filtered for use in the plant. During the summer approximately 136 kg (300 lb) of lime and 82 kg (180 lb) of soda ash/day are used in the softening process; these amounts are doubled during the winter. The filters are backwashed each day. The backwash water flows to the municipal sewer on Osage Street.

A major source of waste is the kettle-house operation where the spent lyes raise the pH of the wastewater to 12 or greater. This waste is neutralized with sulfuric acid (80 %), either in a large-batch tank or on a continuous basis. Local grease traps and separators are employed to remove oils and fats in wastewater from the soap-production processes. The company has the ability to vary the volume of its wastewater flows and possibly can re-route them through the plant.

There are five outfalls to the municipal sewer system. Four of these outfalls connect to the Kansas Avenue Interceptor sewer which flows to the Kaw Point WWTP. The outfall on the southwest corner of company property connects to the Osage Street sewer [Figure C-6] which discharges to the Kansas River (RM 367.5/5.5) approximately 0.8 km (0.5 mile) to the west. The discharge to the Osage Street sewer constitutes the only flow at this location. However, about 0.4 km (0.25 mile) to the west (down sewer), a 1.52-m (5 ft) diameter interceptor sewer combines with the Osage Street sewer.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the effluent to the Osage Street sewer, the Osage Street sewer outfall to the Kansas River, and of the Kansas River upstream of the outfall were collected hourly, and composited on an equal-volume basis. Additional grab samples were taken of the Colgate-Palmolive discharge when the water-softening filters were backwashed. Temperature, pH, and conductivity were measured each time a sample was collected. Instantaneous flows of the Colgate-Palmolive effluent were measured, hourly, with a Marsh-McBirney electromagnetic water-current meter.

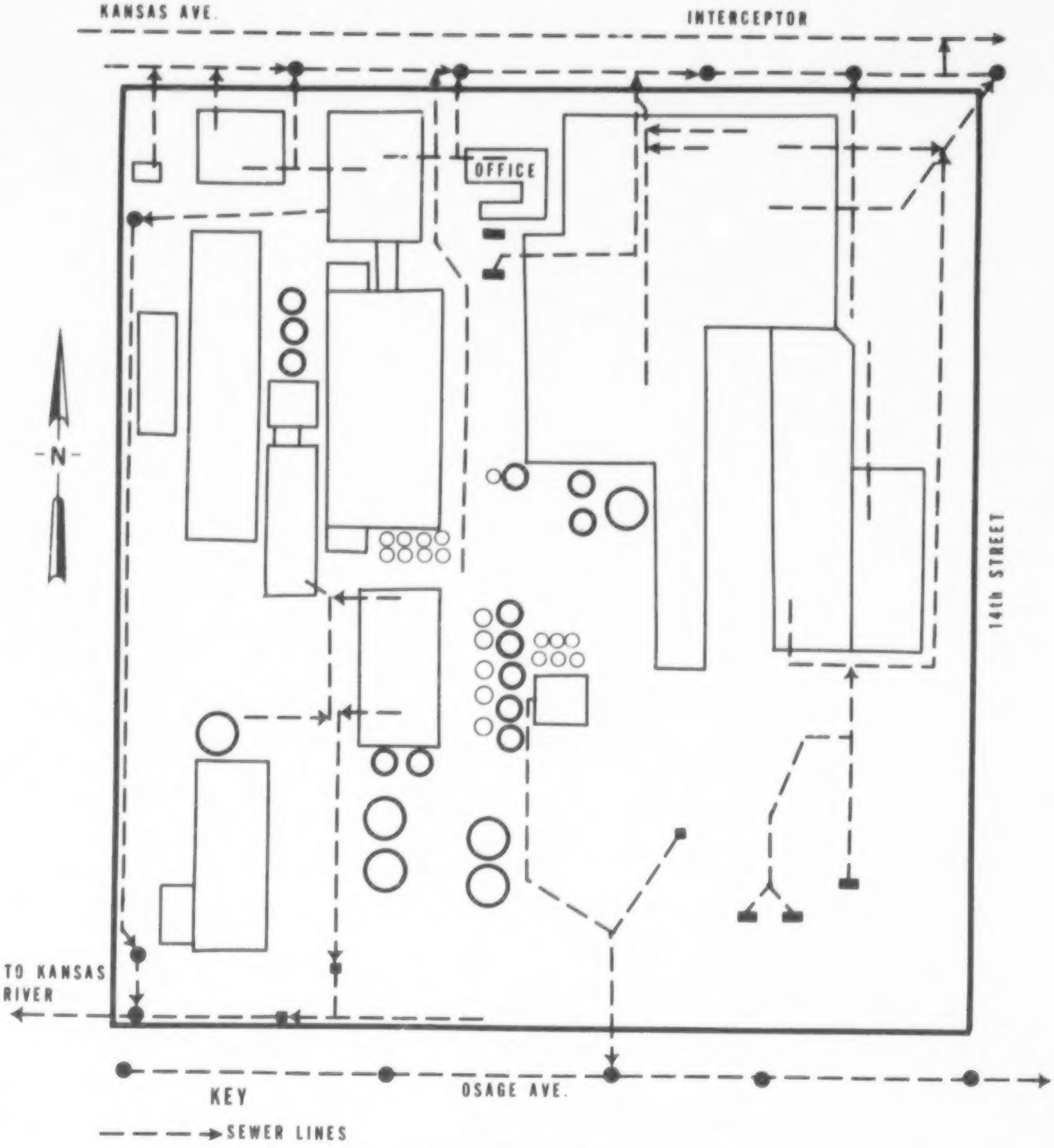
KANSAS AVE.
INTERCEPTOR
OFFICE
N
14th STREET
TO KANSAS RIVER
OSAGE AVE.
KEY
SEWER LINES

Figure C-6. Colgate-Palmolive Company

[Chemical and bacteriological data and field measurements are summarized in Table C-7.] On September 19, 1972, Rhodamine WT dye was introduced into the Colgate-Palmolive effluent and was observed in the Osage Street outfall at the river 15 minutes later.

Company records (April 1971) show that the flow to the Osage Street sewer was 867 m^3/day (0.229 mgd); the concentrations of BOD, COD, and suspended solids were 15 mg/l, 88 mg/l, and 14.5 mg/l, respectively, and the average pH was 8.1. A RAPP application was not filed with the U.S. Army Corps of Engineers. According to the opinion of the legal department of the Colgate-Palmolive Company, a permit was not required.

The average concentrations of BOD, COD, and suspended solids discharged through the Osage Street sewer were 29 mg/l, 77 mg/l, and 140 mg/l, respectively. The suspended-solids concentration was ten times more than that reported in company data. The pH ranged from 6.0 to 10.0. These data indicate that process waters were discharged. In addition, the fecal-coliform bacterial densities ranged from 130 to 17,000/100 ml, indicating that domestic waste was also discharged to the Osage Street sewer. Foam was observed in the waste stream, indicating detergents to be present.

Solids characteristics of the slug discharges of filter backwash water were as follows:

Date	Total Solids mg/l	Suspended Solids mg/l	Volatile Suspended Solids mg/l
Sept. 19	2,800	2,060	120
Sept. 20	1,630	720	160
Sept. 21	3,880	3,080	184

TABLE C-7

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
COLGATE-PALMOLIVE COMPANY, KANSAS CITY, KANSAS
SEPTEMBER 19-21, 1972

Parameter[a]	C-P Effluent to Osage Sewer	Kansas River Upstream of Osage Sewer	Osage Sewer Outfall to Kansas River
Flow (m^3/day)	3,100	21.68×10^6	35,050
Flow (cfs)[b]		8,867	
Flow (mgd)	0.819	5,730	9.26
pH (standard units), range	6.0-10.0	7.3-8.5	7.2-9.4
Temperature (°C), range	24.0-35.5	20.0-27.5	19.0-28.5
Conductivity (μmhos/cm), range	800-1,600	440-580	340-1,000
BOD	29	4.6	15
COD	77	22	34
TOC	16	7	12
Total Solids	1,030	580	745
Suspended Solids	140	221	220
Volatile Suspended Solids	47	35	33
Total Phosphorus as P	11	0.3	0.8
Ortho Phosphate as P	0.5	0.2	0.5
Total Kjeldahl Nitrogen-N	1.0	0.9	1.9
NH_3-N	0.2	0.1	0.4
NO_3 + NO_2-N	2.7	0.6	0.6
Total Coliform Bacteria			
Log Mean (MF/100 ml)	38,000	580,000	1,200,000
Range (MF/100 ml)	5,800-130,000	160,000-5,500,000	410,000-2,700,000
Fecal Coliform Bacteria			
Log mean (MF/100 ml)	3,000	16,000	66,000
Range (MF/100 ml)	130-17,000	4,400-90,000	19,000-370,000
Fecal Streptococci			
Log mean (MF/100 ml)	>4,000	8,700	47,000
Range (MF/100 ml)	350->100,000	2,900-43,000	7,900-110,000

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[a] All values are reported as mg/l, except where specified.
[b] Flow was measured at USGS station, Bonner Springs, Kansas.

The discharges had an average pH of 7.1, were white in color, and had a duration of approximately 30 minutes.

The effects of the Colgate-Palmolive discharge in the Kansas River were not evident owing to the large volume of flow in the Osage Street sewer. On September 20, EPA personnel, using a Marsh-McBirney electromagnetic current meter, made instantaneous flow measurements in the river outfall structure. The average flow was 35,050 m^3/day (9.26 mgd).

D. SUMMARY AND CONCLUSIONS

The data collected during the effluent sampling indicate that the Colgate-Palmolive Company discharged sanitary and process wastewater to the Osage Street sewer which subsequently discharges to the Kansas River. Slug discharges of water-treatment plant filter backwash water were discharged each day and contained approximately 1,650 mg/l of suspended solids. Effects of the Colgate-Palmolive discharge in the Kansas River were not evident because the Osage Street sewer carries a large volume of domestic wastewater.

E. RECOMMENDATIONS

It is recommended that:

1. Pretreatment regulations be established for the company requiring the removal of toxic substances and pollutants to levels that will not inhibit biological treatment or pass through public systems in concentrations or loads inconsistant with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972, if the City of Kansas City, Kansas connects the Osage St. sewer to a wastewater treatment plant, or

2. If the Osage St. sewer is not connected to a wastewater treatment plant, the company meet the requirements in the EPA interim Effluent Guidelines for direct discharges.

C-VII. SIMS BARREL COMPANY
KANSAS CITY, KANSAS

A. GENERAL

The Sims Barrel Company, a subsidiary of International Minerals and Chemical Corporation (Libertyville, Illinois), reclaims, cleans, and paints used 210-liter (55 gal.) barrels. Approximately 1,500 of these barrels are renovated each day; major sources of these barrels include petroleum, chemical and paint companies. The plant operates 8-to-9 hours a day, 5 days/week, and employs 70 people.

From October 3 through 5, 1972, NFIC-D personnel conducted an in-plant survey. Joseph E. Doninger and Jim Burleson of the IMC Corporation provided information and assistance.

B. WASTE SOURCES AND TREATMENT

The amount of water employed in the reclaiming operation and boilers depends upon the quantity of barrels processed. Between 76 and 132 m^3 (20,000 and 35,000 gal.) of municipal water are used each day.

Sanitary wastes have been separated from the industrial waste streams. Both are discharged to the 12th Street sewer which flows into the Kansas River (RM 367.5/4.4), approximately 0.4 km (0.25 mile) south of the company [Figure C-7]. A RAPP application was filed for the discharge.

Industrial waste is pretreated before being discharged to the city sewer. Because of the variety of substances contained in the barrels that are received each day, the company has, for more efficient operation, divided its processes into an oil line and paint line; all barrels containing paints are fed to the paint line; all other barrels, containing chemicals, oils, solvents, etc., go to the oil line.

The barrels are segregated upon arrival. Those containing oils and lubricants pass through an incinerator before proceeding to the oil line. [The oil-line and paint-line sequences are listed in Tables C-8 and 9 and shown in Figure C-7.]

After passing through the oil and paint lines, the barrels are spray-painted in a water curtain paint booth that is drained every two weeks. The paint residue and solids flow to the company treatment plant.

The pretreatment system receives all industrial waste streams. The combined waste flows into a 7.6-m^3 (2,000 gal.) mixing tank divided into eight compartments. Solutions of concentrated sulfuric acid (190-230 1^3/day or 50-60 gpd) and ferric sulfate (90 kg/day or 200 lb/day) are added to the influent to produce a pH of 2 to 3. Sodium hydroxide (190-230 1^3/day or 50-60 gpd.) is added near the end of the tank to produce an effluent pH of 8 to 9. The mixing-tank effluent flows to a 38-m^3 (10,000 gal.) clarifier; the clarifier sludge flows to a lagoon. Settled lagoon sludge is hauled to a landfill, and the lagoon overflow is returned to the influent of the mixing tank. Oil, separated in the clarifier, is stored in a tank and used for fuel in the incinerator. The effluent from the clarifier discharges to the 12th Street sewer. Preflush and outside stripper water from the oil line passes through a oil separator. The recovered oil goes to the oil storage tank.

The company is continuously running pilot studies to improve waste

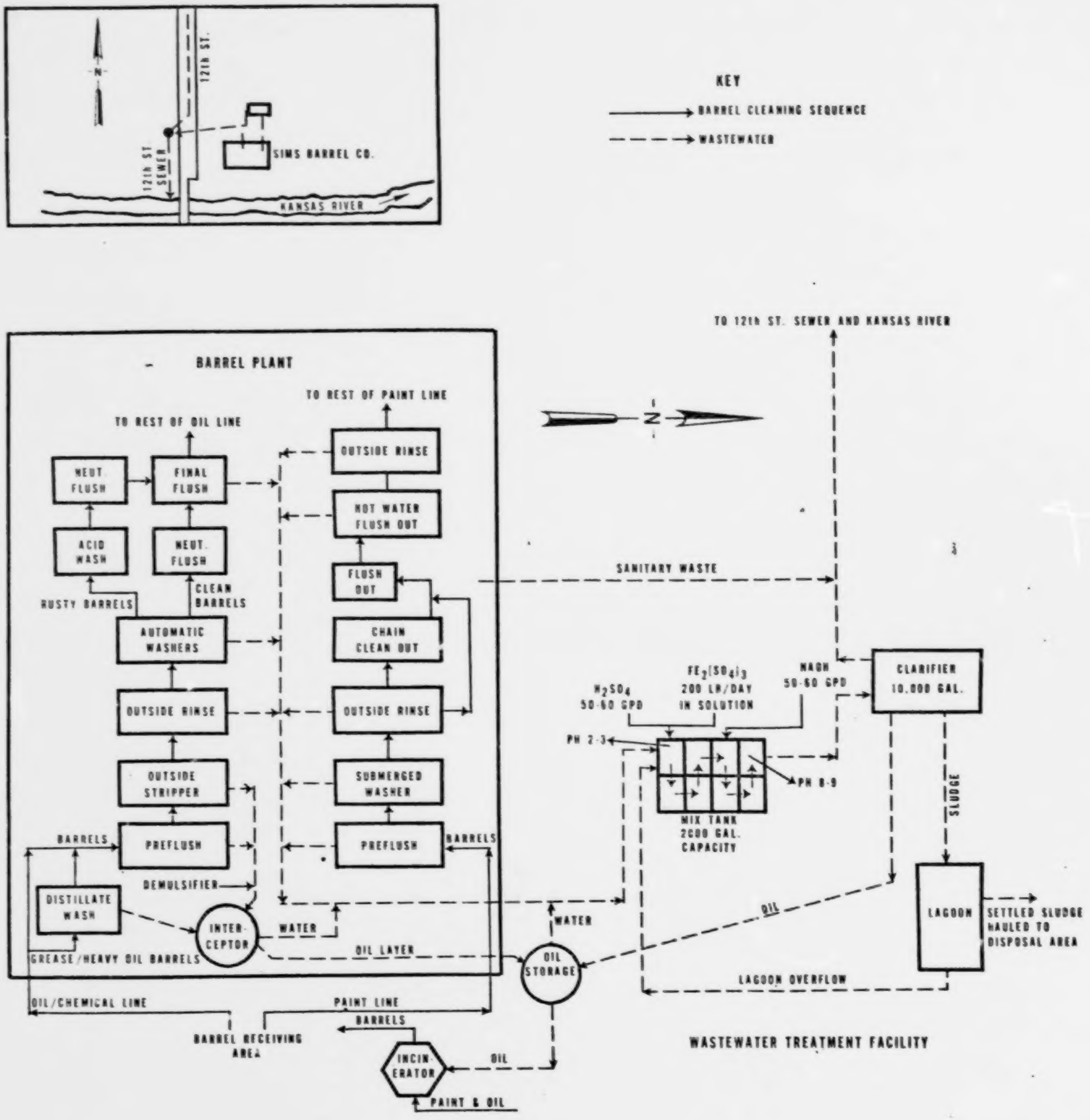
N
12th ST.
12th ST SEWER
SIMS BARREL CO.
KANSAS RIVER
KEY
BARREL CLEANING SEQUENCE
WASTEWATER
BARREL PLANT
TO REST OF OIL LINE
TO REST OF PAINT LINE
NEUT. FLUSH
FINAL FLUSH
ACID WASH
NEUT. FLUSH
RUSTY BARRELS
CLEAN BARRELS
AUTOMATIC WASHERS
OUTSIDE RINSE
OUTSIDE STRIPPER
PREFLUSH
BARRELS
DISTILLATE WASH
DEMULSIFIER
INTER-CEPTOR
WATER
OIL LAYER
GREASE/HEAVY OIL BARRELS
OUTSIDE RINSE
HOT WATER FLUSH OUT
FLUSH OUT
CHAIN CLEAN OUT
OUTSIDE RINSE
SUBMERGED WASHER
PREFLUSH
BARRELS
OIL/CHEMICAL LINE
PAINT LINE
BARREL RECEIVING AREA
BARRELS
INCIN-ERATOR
OIL
PAINT & OIL
OIL STORAGE
WATER
N
TO 12th ST. SEWER AND KANSAS RIVER
SANITARY WASTE
H_2SO_4 50-60 GPD
$FE_2(SO_4)_3$ 200 LB/DAY IN SOLUTION
NAOH 50-60 GPD
PH 2-3
PH 8-9
MIX TANK 2000 GAL. CAPACITY
CLARIFIER 10,000 GAL.
SLUDGE
OIL
LAGOON
SETTLED SLUDGE HAULED TO DISPOSAL AREA
LAGOON OVERFLOW
WASTEWATER TREATMENT FACILITY

Figure C-7. Sims Barrel Plant and Wastewater Treatment Facility

TABLE C-8

SIMS BARREL COMPANY
OIL-LINE OPERATION

Operation	Contaminents[a/] in wastewater
1. Preflush: continuous overflow, drained daily (379 l or 100 gal.)	110,000 ppm oil & grease
2. Outside Stripper: no overflow, drained weekly (5.7-7.6 m^3 or 1,500-2,000 gal.)	63,000 ppm oil & grease
3. Outside Rinse: continuous overflow, drained weekly (1.5 m^3 or 400 gal.)	Not reported
4. Four Automatic Washers, operated in series (soda ash used as caustic wash):	
1st Washer, continuous overflow, drained daily	1,100 ppm oil & grease
2nd Washer, continuous overflow, drained daily	1,500 ppm oil & grease
3rd Washer, no overflow, drained daily	Uses recycled water
4th Washer, continuous overflow, drained weekly	800 ppm oil & grease
5. Neutralization and final flush: cleaned drums are prepared for painting	Not reported
6. Acid wash, neutralization, and final flush: rusty drums are prepared for painting	Not reported

---

[a/] This information was reported June 8, 1972, by Sims Barrel Company.

TABLE C-9

SIMS BARREL COMPANY PAINT-LINE OPERATION

Operation	Contaminents[a/] in wastewater
1. Preflush: no overflow, drained weekly (3.4 m^3 or 900 gal.) water recycled	75,000 ppm oil & grease
2. Submerged Washer: no overflow, drained every 2-3 months (9.4 m^3 or 2,500 gal.), water recycled	75,000 ppm oil & grease
3. Outside rinse: no overflow, drained weekly (1.5-1.9 m^3 or 400-500 gal.) water recycled	Not reported
4. Chain Clean-out: Abrasion, no water used	
5. Flushout: continuous overflow, hot water used on once-through basis (190 l or 50 gal. per hr), drained weekly (1.9 m^3 or 500 gal.)	2,000 ppm oil & grease
6. Outside rinse: continuous overflow, drained weekly (1.1 m^3 or 300 gal.)	Not reported

---

a/ This information was reported June 8, 1972, by Sims Barrel Company.

treatment and incorporating the results into their treatment facility. Therefore, the pretreatment operation is continually changing, to reflect results of their studies.

After the City intercepts the 12th Street sewer (scheduled in 1973), the effluent will flow to the Kaw Point WWTP.

C. PLANT EVALUATIONS AND FINDINGS

Grab samples of the clarifier effluent, the 12th Street sewer outfall to the Kansas River, and of Kansas River water, 100 m upstream of the 12th Street sewer, were collected hourly and composited on an equal volume basis. One well-mixed grab sample -- each for analyses of phenols and oil and grease, was collected daily. Temperature, pH, and conductivity were measured each time a sample was collected. A 60° V-notch weir was installed in the effluent line from the clarifier, and flows were measured with a Stevens Type-F Flow Recorder. [Chemical data and field measurements are summarized in Tables C-10 and 11.]

The effluent characteristics reported in the Refuse Act Permit Program Application were as follows:

	Concentration (mg/l, except where noted)
Flow (m^3/day)	83
Flow (mgd)	0.022
pH (standard units)	12.5
COD	13,097
TOC	4,433
Total Solids	16,080

TABLE C-10

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
SIMS BARREL COMPANY, KANSAS CITY, KANSAS
OCTOBER 3-5, 1972

Parameter[a]	Sims Barrel effluent	Kansas River, upstream of 12th St. sewer	12th St. sewer outfall to Kansas River
Flow (m^3/day)	117	5.38 x 10^6	
Flow (cfs)[b]		2,200	
Flow (mgd)	0.031	1,422	
pH (standard units), range	7.2-11.2	8.5-9.4	6.8-10.6
Temperature (°C), range	25.0-36.5	15.5-21.0	22.5-29.5
Conductivity (µmhos/cm), range	6,500-15,500	700-950	1,500-6,250
BOD	1,300	30	1,650
COD	2,830	86	2,380
TOC	760	21	760
Total Solids	10,900	750	3,600
Suspended Solids	280	300	190
Volatile Suspended Solids	150	71	120
Oil & Grease	180	21	88
Total Phosphorus as P	1.7	1.0	19
Ortho Phosphate as P	0.8	1.0	10
Total Kjeldahl Nitrogen-N	29.6	2.1	11
NH_3-N	0.7	0.2	0.8
NO_3 + NO_2-N	0.8	0.1	1.1
Phenols	11.1	0.10	1.6
Total Lead	1.04	0.06	0.31
Total Zinc	2.39	0.08	0.60
Total Copper	0.159	0.092	0.062
Total Chromium	0.29	0.03	0.08
Total Cadmium	0.08	0.03	0.03
Total Mercury (µg/1)	10.6	2.7	4.5

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[a] All values are reported as mg/1, except where specified.

[b] Flow was measured at USGS station, Bonner Springs, Kansas.

TABLE C-11

ORGANIC COMPOUNDS PRESENT IN CLARIFIER EFFLUENT FROM SIMS BARREL COMPANY AND THE 12TH STREET SEWER, OCTOBER 3, 1972

Parameter	Effluent Concentration μg/l	12th St. sewer Outfall Concentration μg/l
Toluene	280	2
Tetrachlorethylene	220	
Ethylbenzene	140	
m & *p*-Xylene	420	
o-Xylene	310	
n-Hendecane	50	
Trimethylbenzene	35	
n-Dodecane	50	
n-Tridecane	50	15
n-Tetradecane	50	35
Napthalene	100	
t-Butylphenol	170	
2-Methylnapthalene	170	
1-Methylnapthalene	100	
n-Hexadecane	50	70
Dimethylnapthalene	140	
n-Heptadecane	50	70
n-Octadecane	50	70
n-Pentadecane		70
n-Nonadecane		70
n-Eicosane		35
n-Heneicosane		35

Suspended Solids	2,380
Volatile Suspended Solids	1,940
Oil & Grease	2,970
Total Kjeldahl Nitrogen-N	358
NO_3-N	121
Total Phosphorus as P	54
Ortho Phosphate as P	54
Total Aluminum	23
Total Lead	24
Total Zinc	14.5
Total Copper	0.5
Total Chromium	4.9
Total Cadmium	0.06
Phenols	2.2

The flow and the concentration of phenols (11.1 mg/l) discharged to the 12th Street sewer were higher than the reported value; the other constituents were considerably less. The pH remained high, ranging from 7.2 to 11.2, a violation of City Ordinance No. 42913 [Appendix I].

The 12th Street sewer outfall to the Kansas River had concentrations of BOD, COD, TOC, oil and grease, phenols, and heavy metals much higher than those found in domestic waste. Although the flow to the Kansas River was not measured, the fact that the constituents of the 12th Street sewer effluent exhibited the same high values as those found in the Sims Barrel effluent is indicative of this industrial effluent being a contributor of a significant portion of the pollutants found in the sewer.

A variety of organic compounds [Table C-11] were identified in the Sims Barrel effluent. The concentrations were relatively low, but could cause localized degradation in the Kansas River downstream from the discharge. Because most of the compounds found in this effluent are aromatic in nature (resistant to biodegradation), they would be expected to persist in the receiving waters for a long time.

The compounds identified in the 12th Street sewer outfall were *n*-alkanes, as found in petroleum. None of the other compounds found in the Sims Barrel effluent were identified in the sewer outfall.

D. SUMMARY AND CONCLUSIONS

1. The Sims Barrel Company reclaims and cleans barrels from various industrial sources (chemical, petroleum, paints). Wastewater was pretreated before being discharged via the 12th Street sewer to the Kansas River, 0.4 km (0.25 mile) away. The effluent had high concentrations of BOD, COD, TOC, oils and greases, phenols, and heavy metals. These high concentrations were found in the 12th Street sewer effluent, indicating that the Sims Barrel effluent contributed a significant portion of the pollutants. Pretreatment was not adequate.

2. The range of pH of the Sims Barrel effluent rose to 11.2, a level which violated the Kansas City, Kansas Ordinance No. 42913, prohibiting the discharge of any waste with a pH lower than 5.0 or higher than 10.0. The pH of the 12th Street sewer range from 6.8 to 10.6.

3. The company is continually working on its pretreatment methods to develop more efficient and better treatment.

4. The City plans to divert the 12th Street sewer discharge from the river to the Kaw Point WWTP by late 1973.

E. RECOMMENDATIONS

It is recommended that:

1. Pretreatment regulations be established for Sims Barrel Company requiring the removal of toxic substances and pollutants to levels that will not inhibit biological treatment processes or pass through public systems in concentrations or loads inconsistent with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

2. The Sims Barrel Company neutralize the pH of the effluent to comply with the City Ordinance limitations.

C-VIII. ACME PLATING CORPORATION
KANSAS CITY, KANSAS

A. GENERAL

Acme Plating has the facilities to perform all types of metal finishing: chrome, aluminum anodizing, copper, silver, cadmium, brass, gold, tin, solder, and zinc. The custom plating firm operates 24 hr/day, 5 days/week, and employs 26 people. The day shift operates at full capacity, the second shift at one-half capacity, and the third shift at one-fourth capacity. Chrome and zinc plating each make up 30 to 35 percent of the operation.

The firm, because it discharged to a municipal sewer that flows directly into the Kansas River, filed for a permit to discharge into a navigable water under the Refuse Act Permit Program.

From October 3 through 5, 1972, NFIC-D personnel conducted an in-plant survey. Harold L. Copeland, owner of Acme Plating, provided assistance and information.

B. WASTE SOURCES AND TREATMENT

All water is supplied by the City and is employed in the metal solution and re-use tanks and in cooling operations. Mr. Copeland estimated the use at 1,890 m^3/day (0.50 mgd).

In August 1964 the Office of the City Engineer issued the firm a permit to discharge to the Argentine storm sewer which flows into the Kansas River (RM 367.5/5.1) approximately 0.8 km (0.5 mile) to the East [Figure C-8]. It should be noted that the Santa Fe Railroad shops and yards also discharge treated industrial wastes to this storm sewer.

Spills and overflows from the plating and rinse tanks are collected in floor troughs and transmitted to a central trough and floor drain. Although there is no treatment before discharge, good housekeeping techniques are employed in order to minimize waste. Each chemical tank is followed by a recovery tank used to rinse the chemical off the plated item. When the chemical tank requires additional make-up water, water is taken from the recovery tank. The anodizing tank has a titanium coil for cooling while the bright acid tin solution tank has a plastic tube containing cold water. Water is cooled in a 1.8-metric ton (2 ton) Copeland refrigerator; all water is recycled continuously.

The effluent from the plant was analyzed, in 1971, by Gray Laboratories in Kansas City. The analysis was based on grab samples. The results were as follows:

Parameter	Concentration (in mg/l; unless otherwise noted)
Chloride	119
Cyanide	3.3
Sulfate	321
Sulfide	None detected
Aluminum	1.5
Cadmium	2.1
Chromium	3.0
Copper	1.8
Nickel	18.4
Gold	<50 μg/l

C-51-A

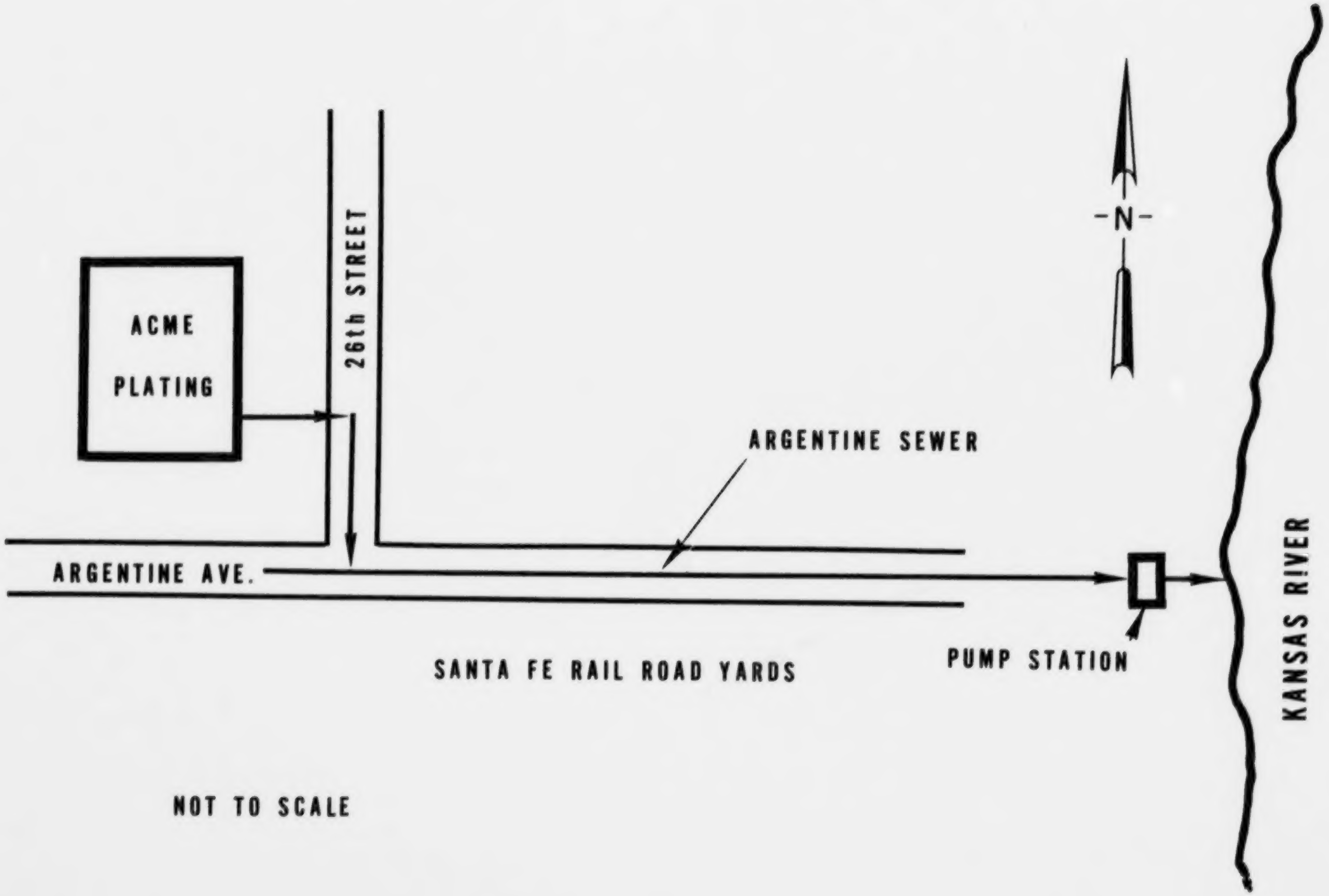
-N-
ACME PLATING
26th STREET
ARGENTINE SEWER
ARGENTINE AVE.
SANTA FE RAIL ROAD YARDS
PUMP STATION
KANSAS RIVER
NOT TO SCALE

Figure C-8. Acme Plating

C. PLANT EVALUATION AND FINDINGS

Grab samples of the Acme Plating effluent, the Argentine sewer outfall to the Kansas River, and of the Kansas River water, 100 m upstream of the outfall of the Argentine sewer were collected hourly and composited on an equal-volume basis. Temperature, pH, and conductivity were measured each time a sample was collected. Flows were obtained from the City water meter. [Chemical and bacteriological data and field measurements are summarized in Table C-12.]

The flow averaged 240 m^3/day (0.064 mgd), considerably less than the 1,890 m^3/day (0.5 mgd) reported, and employees in the plant said that they were operating under normal conditions of water consumption.

The EPA interim Effluent Guidelines have recommended the following limits on discharges from the metal-finishing industry.

Parameter	Concentration (mg/l, except pH)
pH	6-8.5
Suspended Solids	50
Cyanide	0.1
Lead	0.1
Zinc	1.0
Copper	0.5
Chromium	0.5 (solution & suspended solids)
Cadmium	0.2
Nickel	2.0

TABLE C-12

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
ACME PLATING CORP., KANSAS CITY, KANSAS
OCTOBER 3-5, 1972

Parameter[a]	ACME Plating effluent	Kansas River, upstream of Argentine	Argentine sewer outfall to Kansas River
Flow (m^3/day)	240	5.38×10^6	
Flow (cfs)[b]		2,200	
Flow (mgd)	0.064	1,422	
pH (standard units), range	2.8-10.0	7.9-8.9	7.1-8.5
Temperature (°C), range	19.0-22.5	16.0-20.0	19.0-23.5
Conductivity (µmhos/cm), range	650-2,500	650-725	800-2,000
BOD		9.8	42
COD	49	52	83
TOC	9	11	18
Total Solids	788	550	945
Suspended Solids	66	131	21
Volatile Suspended Solids	27	37	13
Cyanide	9.4	<0.02[c]	1.3
Total Lead	0.28	0.06	0.11
Total Zinc	4.40	0.05	0.79
Total Copper	1.03	0.022	0.241
Total Chromium	2.70	0.03	0.66
Total Cadmium	0.45	0.02	0.06
Total Mercury (µg/l)	1.5	1.5	1.3
Total Nickel	2.8	<0.04[c]	2.8

[a] All values are reported as mg/l, except where otherwise specified.

[b] Flow was measured at USGS station, Bonner Springs, Kansas.

[c] These are minimum detectable limits.

The concentrations of heavy metals discharged were less than those reported as discharged in 1971, but higher than the limitations of the interim Effluent Guidelines. (No sanitary sewer is in close proximity to the plant.) Evidence of the Acme Plating discharge is indicated by the metal concentrations in the Argentine sewer. At the concentrations discharged these metals could impart off-flavor to fish and render them undesirable for human consumption.

Cyanide concentrations averaged 9.4 mg/l in the company effluent and 1.3 mg/l in the Argentine sewer. These concentrations are dangerous at low pH because HCN gas is easily released. The pH of the effluent was as low as 2.8. Therefore, a hazardous condition in the plant and sewer was created.

D. SUMMARY AND CONCLUSIONS

1. The Acme Plating Corporation discharged approximately 240 m^3/day (0.064 mgd) of waste containing heavy metals to the Argentine storm sewer that flows to the Kansas River. Concentrations were: lead, 0.28 mg/l; zinc, 4.4 mg/l; copper, 1.03 mg/l; chromium, 2.7 mg/l; cadmium, 0.45 mg/l; nickel, 2.8 mg/l; and mercury, 1.5 μg/l. The concentrations exceeded the EPA interim Effluent Guidelines and were evident in the Argentine-sewer discharge to the Kansas River.

2. The company effluent contained an average of 9.4 mg/l cyanide and had a pH as low as 2.8. This combination produced hazardous conditions in the plant as hydrogen cyanide gas (poisonous) is released under acidic conditions. Similar conditions could occur in the Argentine storm sewer as the cyanide concentration was 1.3 mg/l.

3. The effluent from the Acme Plating Corporation violated City of Kansas City, Kansas, Ordinance No. 42913 which prohibits the discharge of any waste containing more than 2.0 ppm cyanides and any wastes with a pH lower than 5.0 or greater than 10.0.

E. RECOMMENDATIONS

It is recommended that:

1. The Acme Plating Corporation take immediate steps to neutralize its waste to a pH range of 6 to 8.5 and reduce the cyanide concentration to 0.1 mg/l or less.

2. Pretreatment regulations be established requiring the removal of toxic substances and pollutants to levels which will not inhibit biological treatment processes or pass through the public systems in concentrations or loads inconsistent with effluent limitations established pursuant to the Federal Water Pollution Control Act Amendments of 1972, if the Argentine sewer is connected to a wastewater treatment plant by December 31, 1975; or

3. If the Argentine sewer is not connected to a wastewater treatment plant by December 31, 1975, heavy metal concentrations in the effluent shall be reduced to levels in the EPA interim Effluent Guidelines for the metal finishing industry, based on best control technology currently available.

C-IX. PRIVATE BRANDS INCORPORATED--GORDON CORPORATION
KANSAS CITY, KANSAS

A. GENERAL

PBI-Gordon is a formulator and packager of "ready-to-use" chemicals for private brand names. Concentrated materials are purchased in bulk quantities, appropriately formulated, and distributed. Formulation procedures are conducted in batch operations, consisting of both solid products (dusts, powders, granules) and liquid products (solutions, emulsifiable suspensions) in organic or aqueous phases. Formulations include ethylene glycol anti-freeze and 150 varieties of pesticides.

The plant operates on a 40-hr, 5-day week, and employs between 40 to 60 people, depending on seasonal demands.

Because the PBI-Gordon Corporation failed to meet the deadline for filing an application to discharge to a navigable water (Kansas River) under the 1899 Refuse Act Permit Program, enforcement action was taken by Region VII, EPA. The corporation was fined. An application was subsequently filed with the U. S. Army Corps of Engineers.

From July 20 through 21 and September 26 through 28, 1972, NFIC-D personnel conducted in-plant surveys. R. M. Mueller, president, and Everett Mealman, executive vice-president, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

PBI-Gordon has two sources of water for its use, well water and municipal water. Groundwater was used (9,080 m^3 or 2.4 million gal. per year) for condenser cooling water in the esterification process, but this process has been discontinued as esters are now purchased. Yearly consumption of municipal water is itemized as follows:

	Cubic Meters per year	Million Gal. per year
Formulation Water	1,510	0.4
Cooling Water	4,540	1.2
Wash Water	1,140	0.3
Boiler Water	2,080	0.55
Bath Water for Heat-Exchange Purposes	530	0.14
Roto Clone Water	1,890	0.5
Sanitary Water	1,330	0.35
TOTAL	13,020	3.44

Originally, all wastewater from PBI-Gordon flowed to a common wet well and was then discharged to the Kansas River (RM 367.5/1.2) [Figure C-9]. The company has made numerous changes in their process waste discharges. Products are formulated in batches that progress from minimum concentrations to maximum concentrations. Wash water, used to clean mixing vessels, is held in drums and re-used at a later date. Herbicide wash water is scheduled to be broadcasted on weeds located on their property (7.3 hectares or 18 acres). To prevent accidental discharge all known floor drains have been plugged. Sludge from the two Roto Clones (used to collect fine particles suspended in the air) is hauled away to a landfill twice a year. Water used in the Roto Clones is recycled.

The Armourdale sanitary interceptor is the municipal sewer located

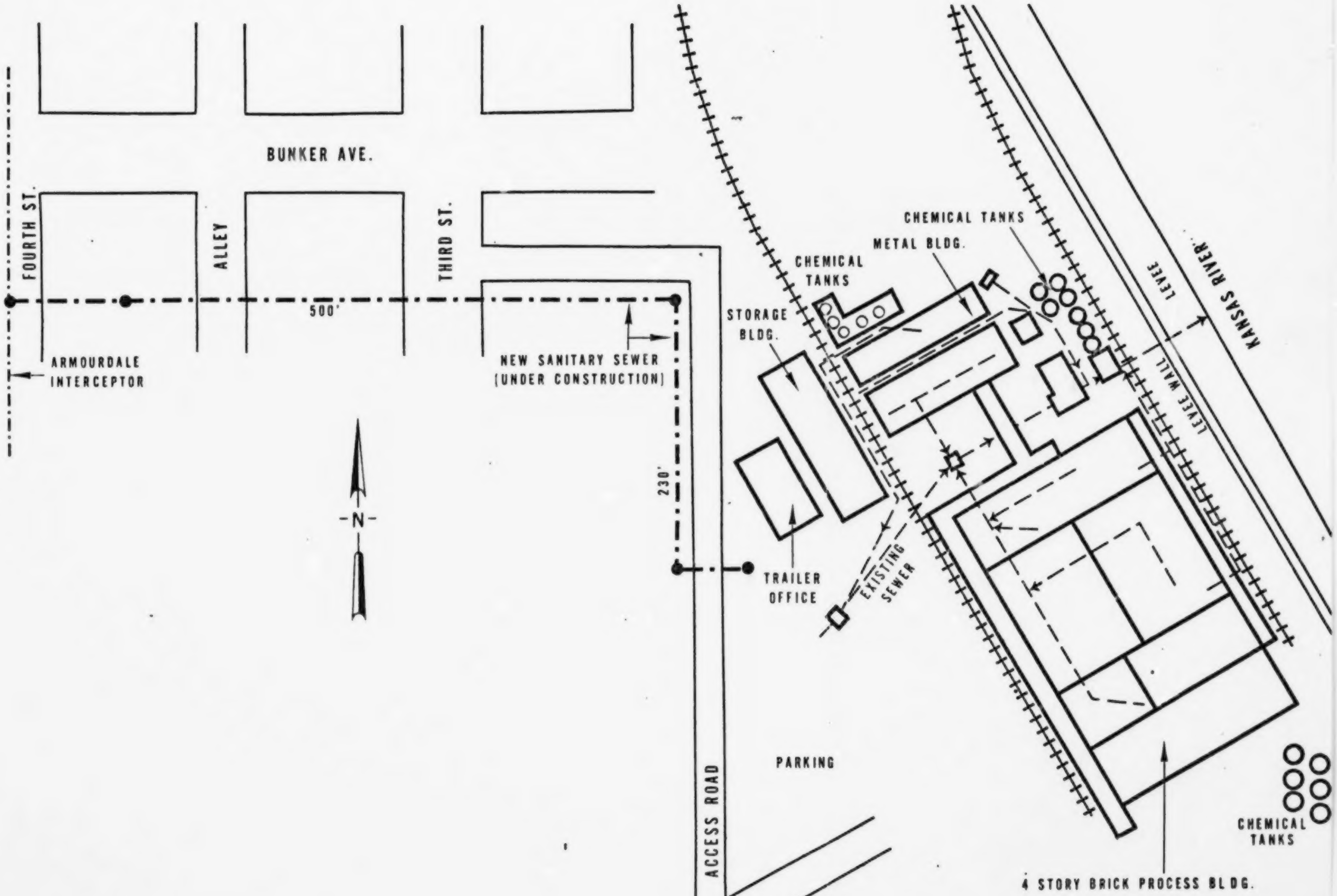
BUNKER AVE.
FOURTH ST.
ALLEY
THIRD ST.
500'
ARMOURDALE INTERCEPTOR
NEW SANITARY SEWER (UNDER CONSTRUCTION)
230'
-N-
ACCESS ROAD
PARKING
TRAILER OFFICE
STORAGE BLDG.
CHEMICAL TANKS
METAL BLDG.
CHEMICAL TANKS
EXISTING SEWER
LEVEE
LEVEE WALL
KANSAS RIVER
CHEMICAL TANKS
4 STORY BRICK PROCESS BLDG.

Figure C-9. Private Brands Incorporated-Gordon Corporation nearest to the company. An 20.3-cm (8 in.) dia. sanitary sewer was installed at company expense (approximately 250 m) and connected to the interceptor in late October 1972. The Director of the Kansas City, Kansas, Water Pollution Control Department has refused to accept any waste other than sanitary because of possible toxicity to proposed biological treatment processes at the Kaw Point WWTP.

Cooling water, boiler water, and bath water (used to provide indirect heating to closed containers immersed in the baths) are discharged to the river.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the PBI-Gordon effluent and Kansas River water, both 100 m upstream of and 10 m downstream from the outfall, were collected hourly and composited on an equal-volume basis. Temperature, pH, and conductivity were measured each time a sample was collected. The effluent flow was measured hourly by recording the time required to fill a 9.5-liter (2.5 gal.) container. [Chemical data and field measurements are summarized in Tables C-13 and 14.]

The effluent characteristics reported in the RAPP application were:

Parameter	Concentration (in mg/l, except where noted)
Flow (m^3/day)	76
Flow (gpd)	20,000
pH (standard units)	7.3
Diazinon	0.025
Malathion	0.476

TABLE C-13

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
PRIVATE BRANDS INCORPORATED-GORDON CORP., KANSAS CITY, KANSAS
JULY 20-21, 1972

Parameter[a]	July 20 Upstream Kansas River	 PBI-Gordon Effluent	 Downstream Kansas River	July 21 Upstream Kansas River	 PBI-Gordon Effluent	 Downstream Kansas River
Flow (m^3/day)	9.51 x 10^6	5.6		18.9 x 10^6	8.2	
Flow (cfs)[b]	3,890			7,750		
Flow (gpd)		1,475			2,175	
pH (standard units), range	7.9-8.0	7.1-7.3	7.7-8.2	7.2-7.9	6.5-8.2	7.0-7.9
Temperature (°C), range	27-28	23-27	27-28	26-29	21-27	26-29
Conductivity (μmhos/cm), range	690-800	1,400-1,700	730-800	580-725	1,200-1,850	575-750
2,4-D Methyl Ester	5	300	9	5	290	6
Banvel-D Methyl Ester	0.3	27	0.2	0.2	51	0.7
Methoxychlor	N.D.[c]	N.D.	N.D.	N.D.	N.D.	N.D.
p-chlorophenol	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
2,4-dichlorophenol	6	125	15	5	40	7

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[a] All values are reported in μg/l, except where specified.

[b] Flow was measured at USGS station, Bonner Springs, Kansas.

[c] N.D. represents none detected.

TABLE C-14

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
PRIVATE BRANDS INCORPORATED-GORDON CORP., KANSAS CITY, KANSAS
SEPTEMBER 26-28, 1972

Parameter[a/]	Sept. 26			Sept. 27			Sept. 28		
	Upstream Kansas River	PBI-Gordon Effluent	Downstream Kansas River	Upstream Kansas River	PBI-Gordon Effluent	Downstream Kansas River	Upstream Kansas River	PBI-Gordon Effluent	Downstream Kansas River
Flow (m^3/day)	10.3×10^6	6.4		9.3×10^6	4.4		8.8×10^6	4.6	
Flow (cfs)[b/]	4,200			3,800			3,600		
Flow (gpd)		1,700			1,160			1,220	
pH (standard units), range	7.6-8.0	6.7-8.6	7.6-8.0	7.9-8.1	6.9-7.3	7.7-8.1	7.8-8.1	6.8-7.3	7.9-8.0
Temperature (°C), range	21-23	18-26	21-23	20.5-22.5	18-20	21-22.5	21-22.5	20-22	21-22.5
Conductivity (μmhos/cm), range	550-580	1,300-2,050	560-600	560-580	1,200-1,700	560-580	575-580	1,350-1,500	600-650
2,4-D Methyl Ester	8	36	5	6	40	9	5	46	12
Banvel-D Methyl Ester	N.D.[c/]	12	0.6	0.8	14	N.D.	N.D.	10	0.5
Methoxychlor	N.D.	6	N.D.	1	6	N.D.	N.D.	3	3
p-chlorophenol	3	180	3	10	35,000	12	N.D.	1,600	N.D.
2,4-dichlorophenol	9	560	11	N.D.	750	3	N.D.	2,000	N.D.

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a/ All values are reported in μg/l, except where specified.
b/ Flow was measured at USGS station, Bonner Springs, Kansas.
c/ N.D. represents none detected.

Chlordane	5.02
Toxaphene	3.62
Disyston	0.074
alpha-; delta-; gamma-BHC	1.28
Isobutyl 2,4-D	0.078

The discharge flow from the plant has been decreased through in-plant changes. The volume ranged from 4.4 to 8.3 m^3/day (1,160 to 2,175 gpd). Isobutyl 2,4-D concentrations ranged from 36 to 300 μg/l and were less than reported values. The concentrations of the herbicides and methoxychlor were not considered toxic. However, the levels of *p*-chlorophenol and 2,4-dichlorophenol might have detrimental effects on the taste of fish and on other aquatic species.

The company was formulating Banvel-D, Mercoprop, and 2,4-D in July and Methoxychlor and technical chlordane in September. The effluent supposedly contained only cooling water, boiler water, and sanitary wastes. Although it was possible that these chemicals could have been deposited in the sewers previously and then washed out during the period of sampling, the concentrations found in the effluent indicate that all drains have not been plugged.

D. SUMMARY AND CONCLUSIONS

1. The PBI-Gordon Corporation has made numerous changes in their operating procedures and wastewater discharges. Wash water is recycled and stored for later use, floor drains have been plugged, sanitary waste is discharged to the city sewer, and product formulation procedures have been revised.

2. However, pesticides were still being discharged to the Kansas River; these pollutants could have been deposited in the sewer from previous operations and then washed out during tthe sampling period.

E. RECOMMENDATIONS

It is recommended that:

1. The PBI-Gordon Corporation conduct additional in-plant surveys in order to locate and eliminate the sources of pollutant entry to the sewer system.

2. The City permit the discharge of all the wastes, with the possible exception of cooling water, to the Armourdale sewer. The wastes should be pretreated to remove toxic substances to levels that will not inhibit treatment of biological treatment systems. If the pollutant sources cannot be eliminated, the discharge shall be contained in an impervious holding basin and monitored for toxic materials before discharge. The PBI-Gordon Corporation should continuously monitor the waste stream and report the data to the City.

C-X. PHILLIPS PETROLEUM COMPANY
KANSAS CITY, KANSAS

A. GENERAL

The Phillips Petroleum Company operates a standard refining process in Kansas City, Kansas. The plant employs 575 people and operates 24-hr/day, 7 days/week. Products manufactured include motor gasoline, distillates, jet turbine fuel, jet and diesel fuel, lube oils, lube oil additives, fuel oil, road oil, asphalt, emulsion asphalt, propane, and butane. The principal raw material is crude oil which is transported to the plant via a pipeline. The plant operates at its maximum capacity, 12,400 m^3/day (78,000 bbl/day). The additional raw materials used are isobutane (consumed in the process) and *n*-butane (used for blending).

Processes used at the refinery include:

Crude-oil fractionation;
Catalytic cracking;
Alkylation;
Catalytic reforming;
Hydrogen desulfurization;
Vacuum distillation;
Propane deasphalting;
Phenol extraction;
Propane dewaxing;
Steam generation;
Chemical treating;
Sulfur production in sulfur recovery unit; and
Blending.

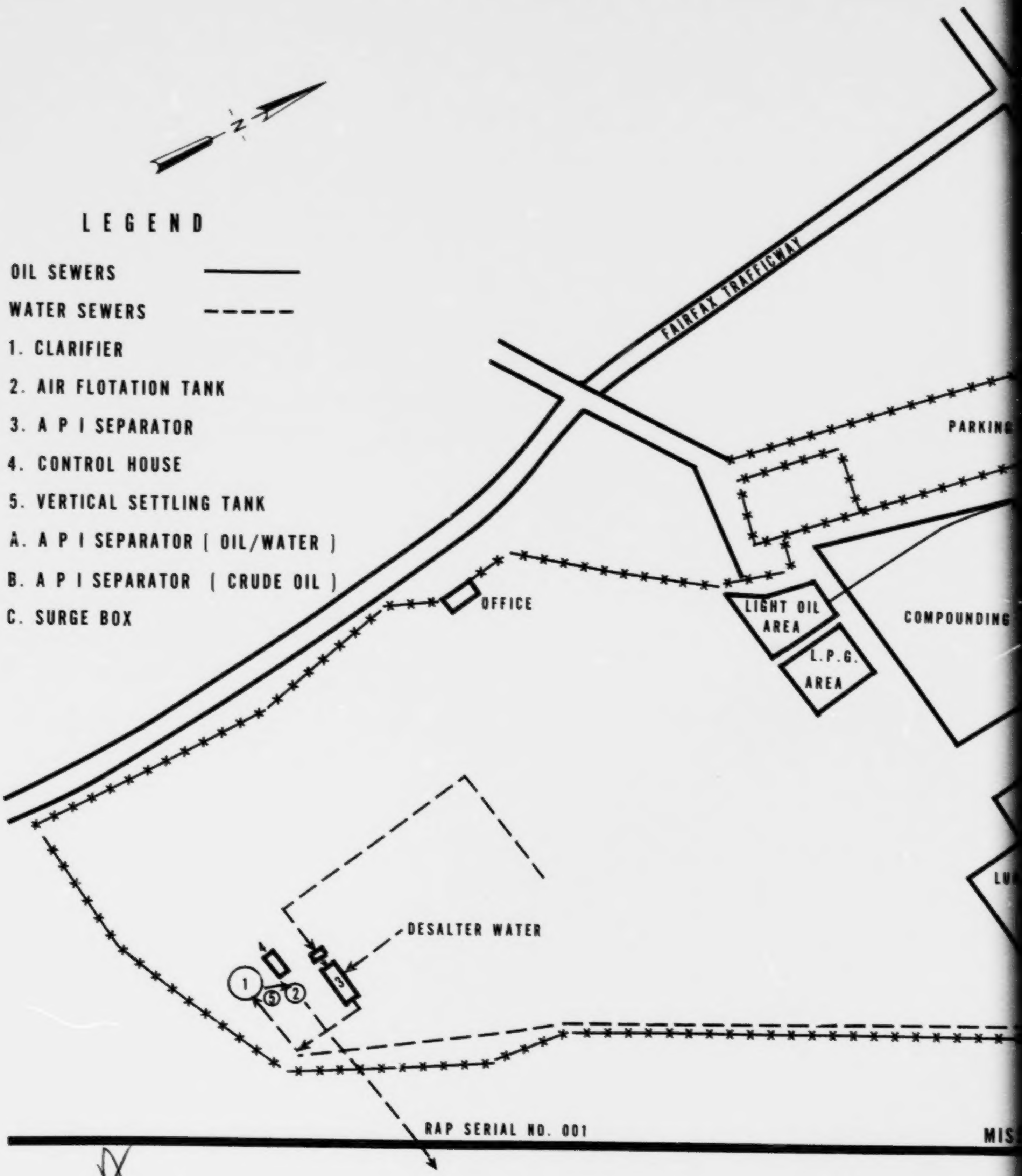
The refinery has been operating continuously, with wastewater discharges to the Missouri River, since 1913. A RAPP application has been filed with the U.S. Army Corps of Engineers for two discharge locations. The discharge (Serial No. 001, RM 368.9) at the southeast corner of the plant property flows continuously and consists of treated industrial wastes. The second discharge (Serial No. 002, RM 369.5), located on the northeast corner of the property, is used only during heavy rains and contains excess water from surface run-off, boiler blowdown, and excess flow (during wet weather) from two API separators [Figure C-10].

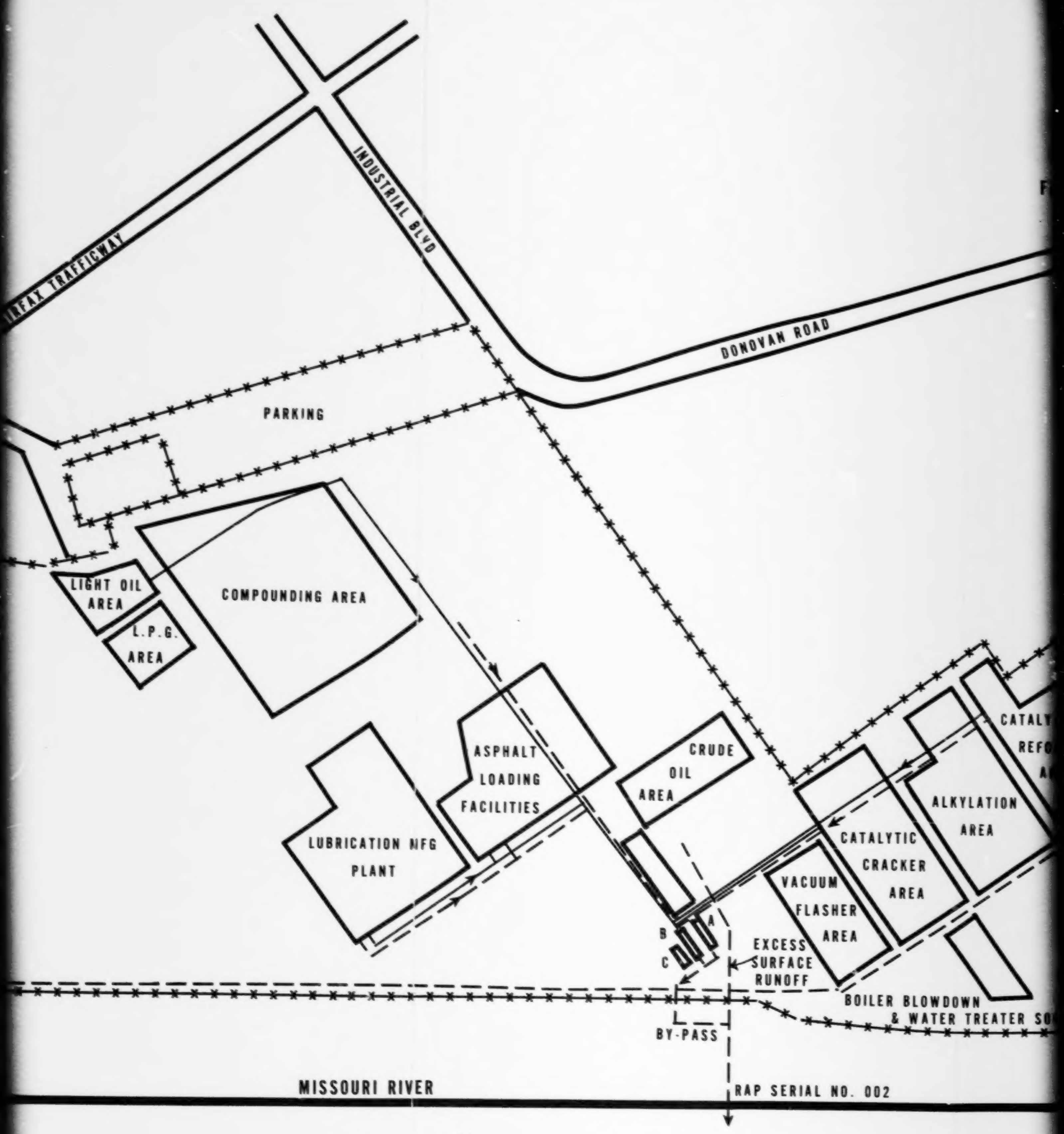
In June 1972, during a thunder shower, an oil slick was observed in the Missouri River near discharge No. 002. The overflow from the surge box (containing oil) at the north end of the plant was being discharged to the river. The EPA Regional Office, Region VII, presented the case to the Federal Grand Jury, in Topeka, Kansas, and the company was indicted on November 8, 1972. The company entered a plea of nolo contendere and was fined $1,000.

NFIC-D personnel conducted, from September 14 through 15, 1972, an in-plant survey. On September 16 the catalytic cracker and support operations were shut down for approximately 4-to-6 weeks for repairs. Jesse W. Scarborough, manager of plant operations, and H. H. Comstock, director of environmental control, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

The plant uses an average of 17,520 m^3/day (4.63 mgd) of water, consisting of municipal water (1,550 m^3/day or 410,000 gpd) and ground


N
LEGEND
OIL SEWERS
WATER SEWERS
1. CLARIFIER
2. AIR FLOTATION TANK
3. A P I SEPARATOR
4. CONTROL HOUSE
5. VERTICAL SETTLING TANK
A. A P I SEPARATOR (OIL/WATER)
B. A P I SEPARATOR (CRUDE OIL)
C. SURGE BOX
FAIRFAX TRAFFICWAY
PARKING
OFFICE
LIGHT OIL AREA
L.P.G. AREA
COMPOUNDING
LU
DESALTER WATER
1
5
2
3
RAP SERIAL NO. 001
MISS



RFAX TRAFFICWAY
INDUSTRIAL BLVD
DONOVAN ROAD
F
PARKING
LIGHT OIL AREA
L.P.G. AREA
COMPOUNDING AREA
ASPHALT LOADING FACILITIES
LUBRICATION MFG PLANT
CRUDE OIL AREA
CATALYTIC CRACKER AREA
ALKYLATION AREA
CATALY
REFO
A
VACUUM FLASHER AREA
A
B
C
EXCESS SURFACE RUNOFF
BOILER BLOWDOWN & WATER TREATER SO
BY-PASS
MISSOURI RIVER
RAP SERIAL NO. 002

C-64-A B

Figure C-10. Phillips

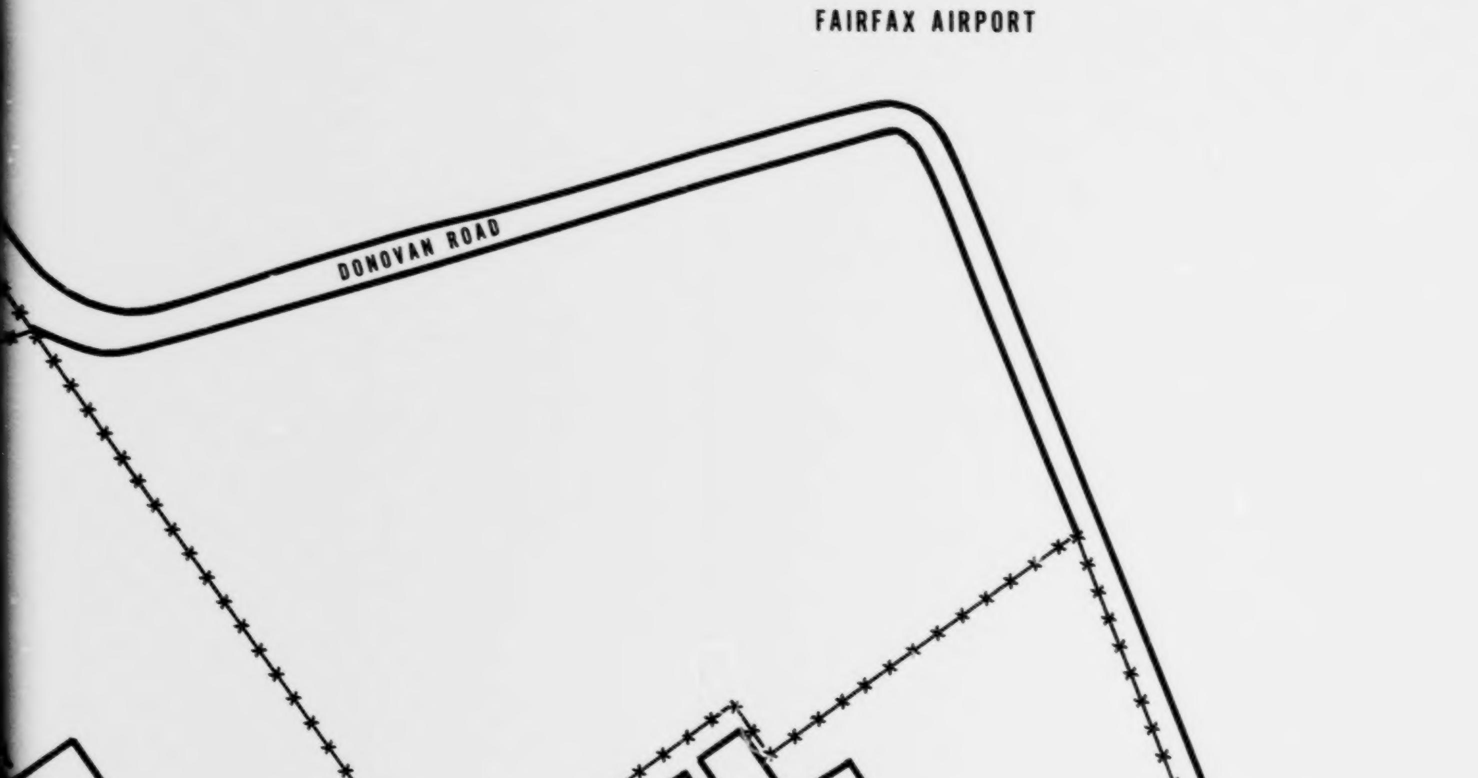

FAIRFAX AIRPORT
DONOVAN ROAD
PHALT
ADING
LITIES
CRUDE
OIL
AREA
CATALYTIC
REFORMER
AREA
ALKYLATION
AREA
CATALYTIC
CRACKER
AREA
VACUUM
FLASHER
AREA
B
A
C
EXCESS
SURFACE
RUNOFF
BOILER BLOWDOWN
& WATER TREATER SOLIDS
BY-PASS
RAP SERIAL NO. 002

Figure C-10. Phillips Petroleum Company

C

water (15,970 m^3/day or 4.22 mgd). The uses are: sanitary, 75.7 m^3/day (20,000 gpd); cooling, 10,560 m^3/day (2.79 mgd); boiler, 5,410 m^3/day (1.43 mgd); and other 1,480 m^3/day (0.39 mgd). Water is not used directly in the refinery processes.

Cooling water is recycled to cooling towers to reduce the volume of make-up water. Full use is made of heat recovery to conserve fuel and reduce cooling make-up water.

Foul or sour process waters are steam stripped for removal of hydrogen sulfide and ammonia. The stripped foul water is re-used by allowing it to become in contact with crude oil in a two-stage electrical crude desalting process; phenol is extracted from the foul water. The desalter effluent is cooled, to control temperature before discharge to an air-flotation unit, then combined with other plant wastewater before being discharged to the waste treatment system employed for crude-oil recovery.

Sanitary wastes are discharged to a septic tank. The effluent from the septic tank flows to the crude-oil, waste recovery system.

Crude-oil spillage is collected throughout the refinery process is allowed and flows to a wet well at the north end of the plant. Wastewater containing oil is similarly collected throughout the refinery process and flows to a wet well adjacent to the crude-oil wet well [Figure C-10]. Two API separators are located next to the wet wells. One is designated as the North API Box (crude oil) and has a capacity of 310 m^3 (81,900 gal.) and size of 6.1 m x 23.8 m x 2.1 m (20 ft x 78 ft x 7 ft): the second is designated as the North API Water Box and has a capacity of 150 m^3

(39,880 gal.) and size of 3.7 m x 19.2 m x 2.1 m (12 ft x 63 ft 4 in. x 7 ft). Separated oil is returned to the crude-oil process. The effluents from these two separators discharge into a surge box (4.6 m x 2.4 m x 2.3 m or 15 ft x 8 ft x 7 ft 7 in.). The entire contents of the surge box is pumped to the clarifier located at the south end of the plant.

A third separator, designated as the South API Oil Box with a 360-m^3 (94,000 gal.) capacity and size of 6.1 m x 24.7 m x 2.4 m (20 ft x 81 ft x 7 ft 9 in.), is located adjacent to the clarifier-flotation facility. This separator receives brine wastes, septic tank effluent, oil recycled from the clarifier, boiler-blowdown water, and water-treatment sludge (hot soda ash and zeolite process). The effluent from the separator is pumped into the clarifier.

The clarifier has a capacity of 4,380 m^3 (1,157,000 gal.) and is (115 ft) in dia., 7.6 m (25 ft) in total height, and a 1.5 m (5 ft) conical bottom. The air-flotation unit (13.0 m or 42.5 ft in dia., 3.3 m or 10 ft 9 in. deep with 0.6-m or 2 ft free board) receives the discharge from the clarifier. The effluent from the air-flotation unit is discharged to the Missouri River (Serial No. 001). Waste oil recovered in the clarifier (skimming device used for collection) is returned to the South API separator. Waste sludge, recovered from the flotation unit, is hauled to a sanitary landfill.

Waste oil recovered from the South API separator passes through a horizontal centrifuge (Super-D-Canter) to remove coarse solids. These solids are then pumped to a vertical sludge-settling and loading tank.

The effluent from the horizontal centrifuge flows to a vertical centrifuge for additional solids removal; these solids are also pumped to the settling and loading tank. The oil from the vertical centrifuge is pumped to a clean oil tank for re-use.

Solids are removed by gravity in the vertical settling and loading tank and transported to the landfill. For further sludge removal the water from the vertical tank is pumped through a small air-flotation unit (2.4 m or 8 ft in dia.). This sludge is hauled to the landfill. Most of the effluent from the small, air-flotation unit returns to the South API separator; a small portion is diverted to the centrifuges in order to maintain a constant flow.

The average flow through the treatment process, under dry-weather conditions, is 7.2-8.3 m^3/minute (1,900-2,200 gpm), 24 hr, 7 days/week.

Storm water is discharged to the Fairfax, combined-sanitary storm sewer that feeds into the Kansas City, Kansas, Kaw Point WWTP. Excess storm water is by-passed to the Missouri River (RM 369.5 and RM 368.9).

There are several methods available to by-pass to the river. Two automatic pumps, located in the crude-oil line and water line at the north end of the plant, discharge directly to a ditch leading to the river (Serial No. 002). These are up sewer of the pumps in the wet wells which pump into the API separators.

The two pumps in the north-area wet well can manually be changed to pump directly to the ditch leading to the river from the wet well. The two pumps that pump the effluent from the surge box to the clarifier also can be manually changed to divert the river. (One of these pumps can take the flow from the pipes connecting the API separators to the surge box while the second pump takes the effluent from the surge box.) When these two pumps are diverted to the river, two additional pumps, located in the mid-section of the plant grounds, pump a portion of the effluent from the surge box to the clarifier. The manual changing of the pumps, diverting flow to the river, occurs when a float device in the surge box trips an alarm, indicating flooding conditions.

At the south end of the plant by-passing is accomplished at the air-flotation unit. The pumps are manually changed to divert the effluent from the clarifier to the river (Serial No. 001) instead of the flotation unit.

C. PLANT EVALUATIONS AND FINDINGS

NFIC-D personnel sampled the company outfall to the Missouri River (Serial No. 001) and Missouri River water, 100 m upstream of and 10 m downntream from the Phillips outfall, hourly and composited the samples on an equal-volume basis. Grab samples for analysis of phenols were taken each day. Skimmed grab samples from the Missouri River and well-mixed grab samples from the outfall for oil-and-grease analysis were taken daily. Flows were obtained from the flow meter attached to the clarifier effluent line. Field measurements for pH, temperature, and conductivity were made each time a sample was collected. [Field measurements and chemical data are summarized in Table C-15.]

The RAPP application listed the following concentrations of constituents in the effluent:

TABLE C-15

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA PHILLIPS PETROLEUM COMPANY, KANSAS CITY, KANSAS SEPTEMBER 14-15, 1972

Parameter[a/]	Phillips Effluent	Mo. River upstream of Effluent	Mo. River downstream from Effluent
Flow (m^3/day)	11,355	288.7×10^6	
Flow (cfs)[b/]		118,000	
Flow (mgd)	3.0	76,265	
pH (standard units), range	7.4-9.0	7.1-7.8	7.0-8.6
Temperature (°C), range	35.0-41.1	20.0-23.5	24-34
Conductivity (μmhos/cm), range	1,450-2,000	450-530	480-1,500
COD	178	56	72
TOC	41	35	35
Total Solids	1,275		
Suspended Solids	32		
Volatile Suspended Solids	11		
Oil & Grease	19.5	2	6
Phenols	1.2	<0.05[c/]	0.58

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a/ All values are average and in mg/l, except where otherwise specified.

b/ Flow was measured at USGS station, Kansas City, Missouri.

c/ These are minimum detectable limits.

Parameter	Daily Avg Concentration, (mg/l, except pH and flow)
Flow (m^3/day)	12,490
Flow (mgd)	3.3
pH (standard units), range	8.2-9.6
COD	102
TOC	32
Total Solids	993
Suspended Solids	69
Volatile Suspended Solids	24
Oil & Grease	14.1
Phenols	507

The concentrations of the effluent constituents were essentially the same as those reported in the RAPP application, with the exception of phenols. The phenol concentration was only 1.2 mg/l instead of 507 mg/l as reported.

A comparison of the EPA interim Effluent Guidelines for the petroleum industry (Class D Integrated plants-topping, catalytic cracking plus lube oil processing) and the actual loads discharged to the Missouri River is as follows:

	Phillips Effluent		Effluent Guidelines Limits	
	lb/1,000 bbl per day	kg/100 m^3 per day	lb/1,000 bbl per day	kg/100 m^3 per day
COD	57	16.3	61	17.4
TOC	13	3.7	16	4.5
Suspended Solids	10.3	2.9	10	2.8
Oil & Grease	6.3	1.8	5.0*	1.4
Phenols	0.4	0.1	0.05	0.01

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* The concentration equivalent is 10 mg/l.

D. SUMMARY AND CONCLUSIONS

1. Except for excess storm water, the Phillips Petroleum Company treats all of its sanitary and industrial wastewater before discharge to the Missouri River. A RAPP application has been filed with the U.S. Army Corps of Engineers.

2. The company was indicted by a Federal Grand Jury on November 8, 1972, for discharging oil to the Missouri River; the company entered a plea of nolo contendere and was fined $1,000.

3. The company effluent met the EPA interim guideline limitations for a Class D refinery except for phenols and oil and grease. The effluent contained 19.5 mg/l of oil and grease (1.8 kg of oil and grease/100 m^3 or 6.3 lb of oil and grease/1,000 bbl, based on two samples) and 0.1 kg phenols/100 m^3 (0.4 lb/1,000 bbl); the guidelines limit these constituents to 1.4 kg/100 m^3 (5.0 lb/1,000 bbl) and 0.01 kg/100 m^3 (0.05 lb/1,000 bbl), respectively. Additional treatment is required to reduce these concentrations to guideline limits.

E. RECOMMENDATIONS

It is recommended that:

1. The loads of oil and grease and phenols, discharged to the Missouri River, be reduced to 1.4 and 0.01 kg/100 m^3/day (5.0 and 0.05 lb/1,000 bbl/day), respectively, by December 31, 1975. These values are based on best practicable control technology currently available for the petroleum industry.

2. The Company shall provide secondary treatment for sanitary wastes, or discharge these wastes to the municipal wastewater treatment plant by December 31, 1975.

C-XI. PENN CENTRAL COMPANY, INC.
KANSAS CITY, KANSAS

A. GENERAL

Penn Central (2727 Roe Blvd.) is located adjacent to Turkey Creek. The company packages and occasionally mixes 950 m^3/week (250,000 gal./week) of oils, chemicals, and anti-freeze for large oil companies. Raw material is received at the plant in bulk form in railroad tank cars and tank trucks. The company employs 50 people and operates 8 hr/day, 5 days/week.

On September 25, 1972, NFIC-D personnel conducted an in-plant survey. Robert Nelling, president, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

Penn Central uses about 150 m^3 (40,000 gal.) of city water per month. Water is used for two boilers and sanitary purposes; none is used in the processes.

According to Mr. Nelling, municipal sewers are not available in the area for waste disposal. Although the company discharges sanitary waste into a septic tank and leach field, they still pay a sewer user charge to the city.

Good housekeeping techniques are practiced inside the packaging area. Spillage, occurring in the packaging area, is cleaned up and recovered; there are no floor drains in the plant. The spillage is collected, placed in a holding tank, and sold to a salvage company.

Outside of the plant, conditions were considerably worse. Oils and greases have been spilled on the ground throughout the area. It was evident that poor techniques were being employed: little care was taken in transferring oil from tank cars to the storage area.

Numerous drop inlets, roof drains, and the boiler blowdown water line are connected to the storm sewer that flows into Turkey Creek [Figure C-11]. Oil is spilled on the plant grounds continually, flows into this sewer, and is carried to Turkey Creek.

C. PLANT EVALUATION AND FINDINGS

Grab samples of the effluent were collected at 8:30 a.m. on September 25, 1972, from the storm sewer outfall to Turkey Creek. Field measurements for pH, temperature, and conductivity were made at the time of sampling. Flow was intermittent and estimated at about 4 l/minute (1 gpm). [Chemical, bacteriological and field measurements are listed in Table C-16.]

Based on the grab samples, the effluent was shown to contain a large amount of organic matter and oil and grease. It is impossible to determine all the sources of the pollutants from the data, but it was evident from the in-plant inspection that a major source of them was the outside area around the plant.

D. SUMMARY AND CONCLUSIONS

1. The Penn Central Company packages petroleum products and antifreeze for large oil companies. Wastes are generated from oil spills on the grounds outside the plant. These oils and other organic materials flow into the plant storm sewer and then into Turkey Creek.

2. Oil spilled in the process areas in the plant are recovered

C-74-a

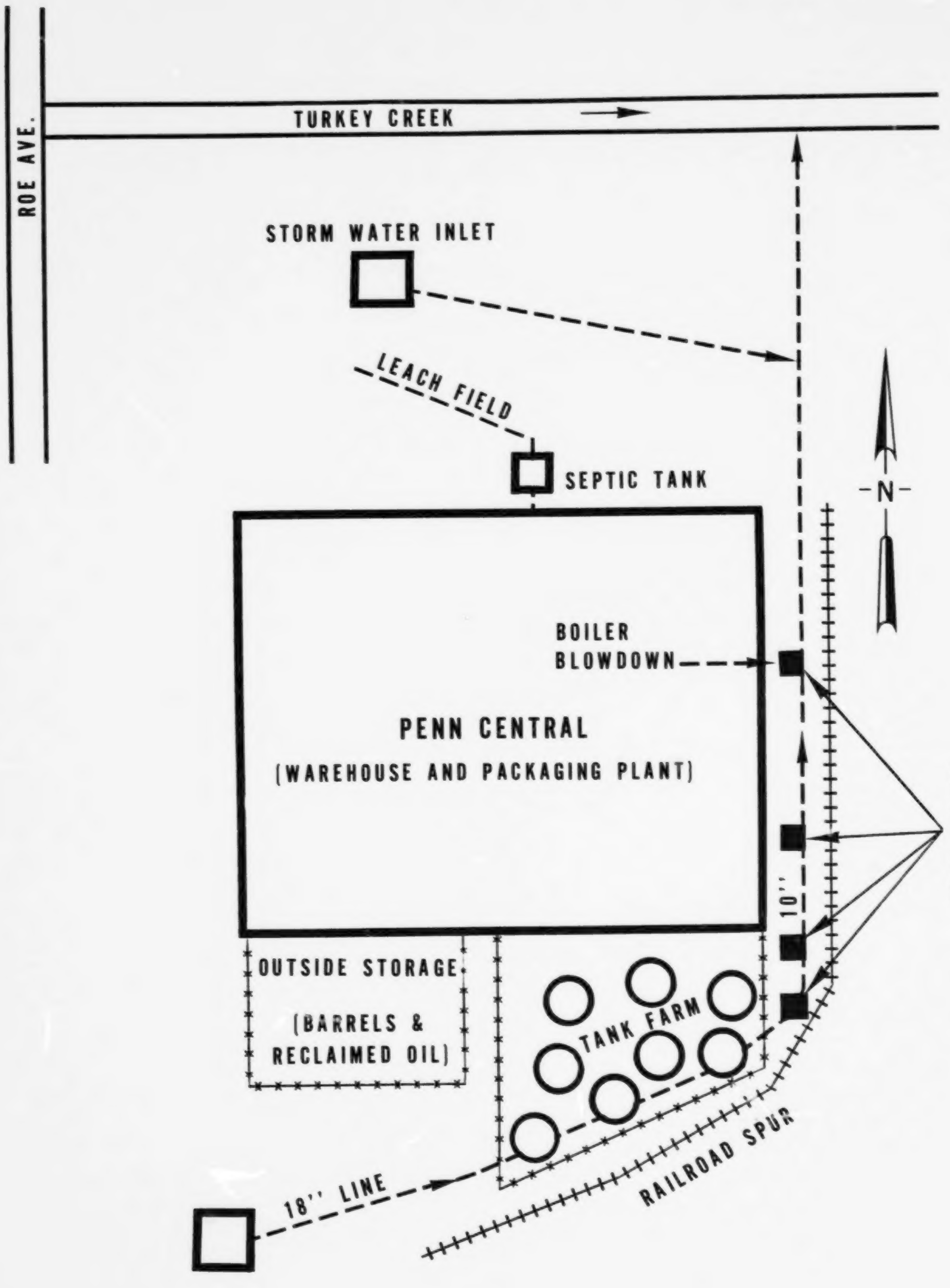

ROE AVE.
TURKEY CREEK
STORM WATER INLET
LEACH FIELD
SEPTIC TANK
N
BOILER BLOWDOWN
PENN CENTRAL (WAREHOUSE AND PACKAGING PLANT)
DROP INLETS
10''
OUTSIDE STORAGE (BARRELS & RECLAIMED OIL)
TANK FARM
RAILROAD SPUR
18'' LINE

Figure C-11. Penn Central Company, Incorporated

TABLE C-16

FIELD MEASUREMENTS, CHEMICAL AND BACTERIOLOGICAL RESULTS
PENN CENTRAL COMPANY, INC., KANSAS CITY, KANSAS
SEPTEMBER 25, 1972
(GRAB SAMPLE: 8:30 AM)

Parameter[a/]	Storm Sewer Effluent
Flow (l/min.)	3.8
Flow (gpm)	1
pH (standard units)	6.5
Temperature (°C)	23
Conductivity (μmhos/cm)	8,000
BOD	360
COD	555
TOC	96
Total Solids	1,100
Suspended Solids	126
Volatile Suspended Solids	76
Oil & Grease	410
Total Coliforms (MF/100 ml)	700,000
Fecal Coliforms (MF/100 ml)	420
Fecal Streptococci (MF/100 ml)	210

[a/] Values are reported in mg/l, except where otherwise specified.

and sold. Floor drains are not available for wash-up purposes.

3. Sanitary sewers are not available in the area according to company officials. All plant sanitary waste flows to a septic tank, then to a leach field. However, the company is still required to pay a sewer user fee to the city.

E. RECOMMENDATIONS

It is recommended that Penn Central practice good housekeeping techniques on their grounds outside of the plant in order to prevent oil and chemical spills reaching Turkey Creek. Protective diking or other approved facilities shall be constructed to contain oil and chemical spills from damaged storage tanks. An implementation schedule shall be submitted to the EPA for approval.

DIRECT DISCHARGES TO RECEIVING STREAMS

This appendix summarizes information obtained in field reconnaissance studies concerning direct discharges to the Kansas River, Turkey Creek, and Jersey Creek, May to October, 1972.

KANSAS RIVER

Discharges to the Kansas River, from RM 10 to its confluence with the Missouri River, were located in June [Table D-1]. Samples were collected from outfalls that were flowing and appeared to consist of domestic or industrial wastes. The Chain-of-Custody procedure [Appendix E] was followed for all samples collected. [Chemical and bacteriological results are shown in Table D-2.]

TURKEY CREEK

Discharges to Turkey Creek were located in the reach from the Wyandotte-Johnson County Line (RM 367.5/3.4/3.8) downstream to the confluence with the Kansas River (RM 367.5/3.4/0) on June 13 through 15, 1972 [Table D-3.] Grab samples were collected on September 25, following the Chain-of-Custody procedure, from outfalls that were flowing. [Chemical and bacteriological results are shown in Table D-4.]

JERSEY CREEK

Discharges to Jersey Creek, from its source at 38th Street, downstream to 13th Street, were located in May [Table D-5]. Grab samples were collected on May 25 and September 25 from flowing outfalls. The Chain-of-Custody procedure was followed for all samples collected on September 25. [Chemical and bacteriological analyses are shown in Table D-4.]

TABLE D-1

OUTFALL LOCATIONS, KANSAS RIVER
RM 10 TO MOUTH
JUNE 15-16, 1972

Key[a]	Reference Point		Description of Outfall			Sampled[d]
No.	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]	Remarks	(Table)
K-1	Lewis and Clark Viaduct	0.32	R	150 m downstream	**76.2-cm dia. flowing**	
K-2	Lewis and Clark Viaduct	0.32	R	75 m downstream	Storm Sewer	
K-3	Lewis and Clark Viaduct	0.32	R	50 m downstream	Flowing, oil/rags evident	
K-4	Lewis and Clark Viaduct	0.32	R	20 m upstream	**61.0-cm dia. flowing**	D-2
K-5	James Street Bridge	0.47	R	50 m downstream	Storm sewer	
K-6	James Street Bridge	0.47	R	70 m upstream	Storm sewer	
K-7	James Street Bridge	0.47	R	100 m upstream	**91.4-cm dia. (Sanitary)** Flowing	
K-8	K.C. Southern R.R. Bridge	0.84	L	100 m downstream	Storm sewer	
K-9	K.C. Southern R.R. Bridge	0.84	R	50 m downstream	Lift station outfall	
K-10	K.C. Southern R.R. Bridge	0.84	R	10 m downstream	Flowing, (Sanitary)	
K-11	Central Ave. Bridge	1.13	R	10 m downstream	Storm sewer	
K-12	Central Ave. Bridge	1.13	L	10 m downstream	Storm sewer	
K-13	Central Ave. Bridge	1.13	L	100 m upstream	Small flow	
K-14	Central Ave. Bridge	1.13	R	150 m upstream	Submerged outfall	
K-15	Central Ave. Bridge	1.13	R	200 m upstream	PBI-Gordon Outfall	D-2,C-12, 13

TABLE D-1 (Cont.)

OUTFALL LOCATIONS, KANSAS RIVER
RM 10 TO MOUTH
JUNE 15-16, 1972

Key[a]	Reference Point		Description of Outfall				Sampled[d]
No.	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]		Remarks	(Table)
K-16	Central Ave. Bridge	1.13	R	400 m	upstream	Storm sewer	
K-17	Mo. Pac. R.R. Bridge	1.48	L	200 m	downstream	Storm sewer	
K-18	Mo. Pac. R.R. Bridge	1.48	L	100 m	downstream	Storm sewer	
K-19	Mo. Pac. R.R. Bridge	1.48	L	20 m	downstream	Submerged outfall	
K-20	U.P. R.R. Bridge	1.49	L	100 m	upstream	**61.0-cm dia. flowing (Sanitary)**	
K-21	Stockyards Bridge	1.68	R	20 m	downstream	Storm sewer	
K-22	Stockyards Bridge	1.68	L	10 m	downstream	Submerged outfall	
K-23	Stockyards Bridge	1.68	L	30 m	upstream	Storm sewer	
K-24	Stockyards Bridge	1.68	R	50 m	upstream	Storm sewer	
K-25	Stockyards Bridge	1.68	R	100 m	upstream	Storm sewer	
K-26	C.R.I. & P.R.R. Bridge	2.01	L	150 m	downstream	Storm sewer	
K-27	C.R.I. & P.R.R. Bridge	2.01	L	100 m	downstream	Submerged outfall	
K-28	C.R.I. & P.R.R. Bridge	2.01	L	50 m	downstream	Storm sewer	

TABLE D-1 (Cont.)

OUTFALL LOCATIONS, KANSAS RIVER
RM 10 to MOUTH
JUNE 15-16, 1972

Key[a]	Reference Point		Description of Outfall			Sampled[d]
No.	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]	Remarks	(Table)
K-29	E. Kan. Ave. Bridge	2.09	R	150 m downstream	Flowing	
K-30	E. Kan. Ave. Bridge	2.09	R	100 m downstream	Flowing	
K-31	E. Kan. Ave. Bridge	2.09	R	10 m upstream	Storm sewer	
K-32	E. Kan. Ave. Bridge	2.09	R	100 m upstream	G-K Warehouse Outfall	
K-33	E. Kan. Ave. Bridge	2.09	L	500 m upstream	K.C. Mo. Tur. Cr. Storm sewer	
K-34	K.C. Terminal R.R. Bridge	2.50	R	100 m downstream	Storm sewer	
K-35	K.C. Terminal R.R. Bridge	2.50	R	100 m upstream	Storm sewer	
K-36	K.C. Terminal R.R. Bridge	2.50	L	100 m upstream	Flowing	
K-37	K.C. Terminal R.R. Bridge	2.50	R	200 m upstream	Storm sewer	
K-38	K.C. Terminal R.R. Bridge	2.50	L	500 m upstream	Storm sewer	
K-39	Turkey Creek Tunnel	3.40	L	Turkey Creek Confluence		D-2;V1-8,9
K-40	7th St. Bridge	3.50	R	400 m downstream	Midwest Cold Storage Outfall	

TABLE D-1 (Cont.)

OUTFALL LOCATIONS, KANSAS RIVER
RM 10 to MOUTH
JUNE 15-16, 1972

Key [a]	Reference Point		Description of Outfall				Sampled[d]
No.	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]		Remarks	(Table)
K-41	7th St. Bridge	3.50	L	25 m	upstream	**Two 91.4-cm dia. sewers, (Sanitary)**	D-2
K-42	7th St. Bridge	3.50	R	300 m	upstream	Storm sewer	
K-43	12th St. Bridge	4.30	L	350 m	downstream	45.7-cm dia. (Sanitary)	D-2
K-44	12th St. Bridge	4.30	L	300 m	downstream	**Two 91.4-cm dia. Storm** sewers	
K-45	12th St. Bridge	4.30	R	25 m	upstream	**12th St. sewer (Sanitary)**	D-2, C-9
K-46	12th St. Bridge	4.30	L	150 m	upstream	Flowing	
K-47	12th St. Bridge	4.30	L	200 m	upstream	Flowing (Sanitary)	D-2
K-48	18th St. Bridge	5.0	L	275 m	downstream	Storm sewer	
K-49	18th St. Bridge	5.0	L	200 m	downstream	Storm sewer	
K-50	18th St. Bridge	5.0	L	100 m	downstream	Flowing (sanitary)	
K-51	18th St. Bridge	5.0	L	75 m	downstream	**183 cm x 183 cm Culvert (Sanitary)**	D-2
K-52	18th St. Bridge	5.0	R	10 m	downstream	Storm sewer	
K-53	18th St. Bridge	5.0	L	100 m	upstream	**122 cm x 183 cm Culvert**	

TABLE D-1 (Cont.)

OUTFALL LOCATIONS, KANSAS RIVER
RM 10 TO MOUTH
JUNE 15-16, 1972

Key[a]	Reference Point		Description of Outfall			Sampled[d]
No.	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]	Remarks	(Table)
K-54	18th St. Bridge	5.0	R	150 m upstream	Storm sewer	
K-55	18th St. Bridge	5.0	L	200 m upstream	2.44 m x 3.66 m Culvert; Argentine sewer	D-2,C-11
K-56	18th St. Bridge	5.0	L	300 m upstream	Storm sewer	
K-57	W. Kan. Ave. Bridge	5.78	R	350 m downstream	Kaw Power cooling water	
K-58	W. Kan. Ave. Bridge	5.78	R	275 m downstream	Osage St. sewer	D-2,C-7
K-59	W. Kan. Ave. Bridge	5.78	R	250 m downstream	Kaw Power Intake Overflow	
K-60	W. Kan. Ave. Bridge	5.78	R	100 m downstream	Proctor & Gamble outfall	
K-61	34th St. Sewer	6.6	R		Flowing, (sanitary)	D-2
K-62	183-cm dia. Storm sewer	6.8	R			
K-63	Turner Bridge	9.33	R	800 m downstream	Sand dredging outfall	
K-64	Turner Bridge	9.33	L	20 m downstream	WWTP No. 8 outfall	
K-65	Turner Bridge	9.33	L	500 m upstream	Sand dredging outfall	
K-66	Turner Bridge	9.33	L	950 m upstream	Storm sewer, flowing	

a/ Key number corresponds to key number, Table D-2.
b/ R = right riverbank facing upstream, L = left riverbank facing upstream
c/ One meter is equivalent to 100 cm, 1.094 yd, 3.281 ft, or 39.37 in.
d/ If outfall was flowing, it was sampled: Table nos. designated list characteristics.

TABLE D-2

EFFLUENT CHARACTERISTICS OF DIRECT DISCHARGES TO KANSAS RIVER
JULY-SEPTEMBER-OCTOBER, 1972

Key[a/] No.	Date Sampled	pH S.U.	Temp °C	Cond. μmhos/cm	BOD mg/1	COD mg/1	TOC mg/1	T.S. mg/1	T.S.S. mg/1	V.S.S. mg/1	Total Coliform MF/100 ml	Fecal Coliform MF/100 ml	Fecal Streptococci MF/100 ml
K-4	9/25	7.7	20.5	900							16,000,000	820,000	360,000
K-7	9/25	9.4	23.5	1400							55,000,000	2,800,000	460,000
K-15	9/26-9/28	7.0	20	1475									
K-39	7/10-7/15	7.3	24.5	1250							3,800,000	210,000	64,000
K-41	9/25	7.7	20	1200							43,000,000	2,200,000	550,000
K-43	9/25	11.6	23.5	6000							2,000	100	440,000
K-45	10/4-10/6	7.7	27	2820	1650	2380	760	3600	190	120	88,000,000	1,400,000	110,000
K-47	9/25	7.8	21	1100							81,000,000	6,300,000	800,000
K-51	9/25	7.6	23.5	1300							94,000,000	4,000,000	2,000,000
K-55	10/4-10/6	7.6	22	1380	42	83	18	945	21	13	7,800	490	2,000
K-58	9/20-9/22	8.4	25.5	730	15	34	12	745	220	33	1,200,000	66,000	47,000
K-61	9/25	7.6	20.5	790	52	128	33	913	48	42	16,000,000	1,300,000	99,000

a/ Key number corresponds to key number, Table D-1.

TABLE D-3

OUTFALL LOCATIONS, TURKEY CREEK
WYANDOTTE COUNTY LINE TO KANSAS RIVER
JUNE 13-15, 1972

Key[a] No.	Reference Point Description	Reference Point RM	Bank[b]	Description of Outfall Distance/Direction from Ref. Point[c]			Description of Outfall Remarks	Sampled[d] (Table)
T-1	7th St. Bridge	0.6	R	75	m	downstream	76.2-cm dia. storm sewer	
T-2	7th St. Bridge	0.6	R	20	m	downstream	61.0-cm dia. (sanitary) flowing	D-4
T-3	7th St. Bridge	0.6	L	5	m	downstream	45.7-cm dia. storm sewer	
T-4	7th St. Bridge	0.6	R	5	m	upstream	106.7-cm dia. storm sewer	
T-5	7th St. Bridge	0.6	L	450	m	upstream	2.44-m Horseshoe (sanitary)	D-4
T-6	7th St. Bridge	0.6	R	500	m	upstream	1.22-m dia. storm sewer	
T-7	7th St. Bridge	0.6	L	685	m	upstream	1.52-m dia. storm sewer	
T-8	7th St. Bridge	0.6	L	590	m	upstream	45.7-cm dia. storm sewer	
T-9	7th St. Bridge	0.6	R	700	m	upstream	38.1-cm dia. storm sewer	
T-10	7th St. Bridge	0.6	R	800	m	upstream	213.4 cm x 106.7 cm storm culvert	

TABLE D-3 (Cont.)

OUTFALL LOCATIONS, TURKEY CREEK
WYANDOTTE COUNTY LINE TO KANSAS RIVER
JUNE 13-15, 1972

Key[a] No.	Reference Point		Description of Outfall			Sampled[d] (Table)
	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]	Remarks	
T-11	7th St. Bridge	0.6	L	900 m upstream	30.5-cm dia. flowing (Sanitary)	D-4
T-12	I-35 Access Ramp	1.0	R	50 m downstream	91.4-cm dia. storm sewer	
T-13	I-35 Access Ramp	1.0	R	300 m upstream	91.4-cm dia. storm sewer	
T-14	Frisco R.R. Bridge	1.2	R	200 m downstream	61.0-cm dia. storm sewer	
T-15	Frisco R.R. Bridge	1.2	R	100 m downstream	5.1-cm dia. flowing	
T-16	Frisco R.R. Bridge	1.2	R	5 m downstream	0.6-m dia. storm sewer	
T-17	Frisco R.R. Bridge	1.2	L	10 m upstream	152.4-cm dia. storm sewer	
T-18	Southwest Blvd. Bridge	1.3	R	5 m downstream	45.7-cm dia. storm sewer	
T-19	Southwest Blvd. Bridge	1.3	R	5 m upstream	30.5-cm dia. storm sewer	
T-20	8th St. Bridge	1.7	R	Underneath Bridge	61.0-cm dia. storm sewer	
T-21	8th St. Bridge	1.7	L	Underneath Bridge	61.0-cm dia. storm sewer	

TABLE D-3 (Cont.)

OUTFALL LOCATIONS, TURKEY CREEK
WYANDOTTE COUNTY LINE TO KANSAS RIVER
JUNE 13-15, 1972

Key[a] No.	Reference Point		Description of Outfall			Sampled[d] (Table)
	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]	Remarks	
T-22	8th St. Bridge	1.7	L	175 m upstream	**2.44 m x 3.05 m storm culvert**	
T-23	Roe Blvd. Bridge	2.4	L	300 m downstream	Penn Central **discharge**	D-4,C-15
T-24	Roe Blvd. Bridge	2.4	R	100 m downstream	**152.4-cm dia. conc.** pipe (sanitary)	
T-25	Roe Blvd. Bridge	2.4	L	10 m downstream	**15.2-cm dia. (sanitary)**	
T-26	Roe Blvd. Bridge	2.4	R	100 m upstream	**91.4-cm dia. storm** sewer	
T-27	18th St. Expressway Bridge	2.8	L	180 m downstream	**152.4 cm x 121.9 cm storm culvert**	
T-28	18th St. Expressway Bridge	2.8	L	150 m downstream	**76.2-cm dia. (sanitary)**	
T-29	18th St. Expressway Bridge	2.8	L	130 m downstream	**38.1 cm dia. storm sewer**	
T-30	18th St. Expressway Bridge	2.8	R	Underneath Bridge	Storm culvert	
T-31	18th St. Bridge	2.9	R	5 m downstream	Drainage ditch	
T-32	Railroad Bridge	3.0	R	15 m upstream	**WWTP No. 5 effluent**	B-4
T-33	Lamar Ave. Bridge	3.8	L	500 m downstream	**91.4-cm dia. storm** sewer	

TABLE D-3 (Cont.)

OUTFALL LOCATIONS, TURKEY CREEK
WYANOTTE COUNTY LINE TO KANSAS RIVER
JUNE 13-15, 1972

Key[a] No.	Reference Point		Description of Outfall				Sampled [d] (Table)
	Description	RM	Bank[b]	Distance/Direction from Ref. Point[c]		Remarks	
T-34	Lamar Ave. Bridge	3.8	R	400 m	downstream	Small creek (unnamed)	
T-35	Lamar Ave. Bridge	3.8	L	300 m	downstream	**Johnson County WWTP effluent**	B-14,15
T-36	Lamar Ave. Bridge	3.8	L	165 m	downstream	**167.6-cm dia. sewer** (oil present)	

[a] Key number corresponds to key number, Table D-4.
[b] R = Right riverbank facing upstream, L = Left riverbank facing upstream
[c] **One meter is equivalent to 100 cm, 1.094 yds, 3.281 ft, or 39.37 in.**
[d] **If outfall was flowing, it was sampled: Table nos. designated list characteristics.**

TABLE D-4

EFFLUENT CHARACTERISTICS OF DIRECT DISCHARGES
TURKEY CREEK AND JERSEY CREEK
MAY 25 AND SEPTEMBER 25, 1972

Key[a] No.	Date	pH S.U.	Temp °C	Cond. µmhos/cm	BOD mg/1	COD mg/1	TOC mg/1	T.S. mg/1	T.S.S. mg/1	V.S.S. mg/1	Total Coliform MF/100 ml	Fecal Coliform MF/100 ml	Fecal Streptococci MF/100 ml
Turkey Creek													
T-2	Sept.	6.5	23	8,000	140	438	96	1730	206	178	83,000,000	2,200,000	2,900,000
T-5	Sept.	7.1	22	1,500	47	117	18	900	46	38	43,000,000	1,400,000	98,000
T-11	Sept.	6.9	23.5	800							3,500,000	2,000,000	91,000
T-23	Sept.	6.8	18.5	1,300	360	555	96	1100	126	76	700,000	420	210
Jersey Creek													
J-14	May	7.0	15.5	1,325	1.6	14			32		62,000	2,500	
J-17	May	7.4	18.5	900	275	497			505		>8,000,000	400,000	
J-19	May	7.3	18	1,100	205	258			250		>8,000,000	1,800,000	
	Sept.	7.2	18	1,200	1.3	14	2	1080	13	13	20,000	1,200	2,800
J-22	May	7.3	18	1,000	34	55			55		>8,000,000	900,000	
J-24	May	7.1	17.5	1,100	220	350			285		>8,000,000	1,600,000	
	Sept.	7.3	22	1,200	190	340	120	884	344	276	63,000,000	3,100,000	2,700,000

[a] Key numbers refer to key numbers in Tables D-3 and D-5

TABLE D-5

OUTFALL LOCATIONS, JERSEY CREEK
38TH STREET TO 13TH STREET
MAY 15-19, 1972

Key[a]	Reference Point	Description of Outfall		
No.		Bank[b]	Distance/Direction from Ref. Point[c]	Remarks
J-1	38th St. & Everett Ave.		At Source	61.0-cm dia. storm sewer
J-2	38th St. & Everett Ave.		At Source	10.2-cm dia. storm sewer
J-3	37th St.	L	At Oakland St.	61.0-cm dia. storm sewer
J-4	29th St.	L	West Side of 29th St. Bridge	91.4-cm dia. storm sewer
J-5	29th St.	R	East Side of 29th St. Bridge	45.7-cm dia. storm sewer
J-6	29th St.	R	5 m downstream	91.4-cm dia. storm sewer
J-7	27th St.	R	At 27th St.	91.4-cm dia. storm sewer
J-8	27th St.	R	150 m downstream	91.4-cm dia. storm sewer
J-9	26th St.	L	100 m downstream	76.2-cm dia. storm sewer
J-10	25th St.	L	15 m upstream	106.7-cm dia. storm sewer
J-11	22nd St.	L	25 m upstream	61.0-cm dia. storm sewer
J-12	22nd St.	L	10 m upstream	61.0-cm dia. storm sewer
J-13	Wood Ave.	R	15 m downstream	10.2-cm dia. storm sewer
J-14	Wood Ave.	R	150 m downstream	121.9-cm dia. storm sewer
J-15	Garfield Ave.	R	15 m downstream	10.2-cm dia. storm sewer

TABLE D-5 (Cont.)

OUTFALL LOCATIONS, JERSEY CREEK
38TH STREET TO 13TH STREET
MAY 15-19, 1972

Key[a] No.	Reference Point	Description of Outfall		
		Bank[b]	Distance/Direction from Ref. Point[c]	Remarks
J-16	Garfield Ave.	R	60 m downstream	**10.2-cm dia. sanitary sewer**
J-17	Garfield Ave.	R	200 m downstream	**38.1-cm dia. sanitary sewer**
J-18	Garfield Ave.	R	250 m downstream	**10.2-cm dia. sanitary sewer**
J-19	18th St.	L	At Troup St.	**Pipe hidden (sanitary)**
J-20	18th St.	R	At Troup St.	**15.2-cm dia. sanitary sewer**
J-21	18th St.	R	30 m upstream near **Parallel Avenue**	**10.2-cm dia. sanitary sewer**
J-22	18th St.	R	At Chelsea Trafficway	**2.44 m x 3.05 m culvert (No. Jersey Creek)**
J-23	17th St.	L	West side of 17th St.	**61.0-cm dia. storm sewer**
J-24	16th St.	L	15 m upstream	**45.7-cm dia. sanitary sewer**

[a] Key number corresponds to key number, Table D-4.

[b] R - Right streambank facing upstream, L - left streambank facing upstream

[c] **One meter is equivalent to 100 cm, 1.094 yd, 3.281 ft, 39.37 in.**

CHAIN-OF-CUSTODY PROCEDURES

POLICY: Chain-of-Custody procedures will be followed on sufficient samples to prove a water quality standard violation and a Refuse Act violation should court action ensue.

General:

The evidence gathering portion of a survey should be characterized by the absolute minimum number of samples required to give a fair representation of the effluent or water body from which taken.

The quantity of samples and sample locations will be determined prior to the survey and based on the requirements to establish a Refuse Act (civil or criminal) and Water Quality Standards violation.

Chain-of-Custody record tags will be prepared prior to the actual survey field work and will contain as much information as possible to minimize clerical work by field personnel. The source of each sample should also be written on the container itself prior to any field survey work.

Field log sheets will also be pre-filled to the extent possible to minimize repetitive clerical field entries.

Chain-of-custody procedures must be followed to maintain the documentation necessary to trace sample possession from the time taken until the evidence is introduced into court. A sample is in your "custody" if:

1. It is in your actual physical possession, or
2. It is in your view, after being in your physical possession, or
3. It was in your physical possession and then you locked it up in a manner so that no one could tamper with it.

All survey participants will receive a copy of the study plan and will be knowledgeable of its contents prior to the survey. A pre-survey briefing will be held to reappraise all participants of the survey objectives, sample locations and Chain-of-Custody procedures. After all Chain-of-Custody samples are collected, a de-briefing will be held in the field to determine adherence to Chain-of-Custody procedures and whether additional evidence type samples are required.

Sample Collection:

1. To the maximum extent achievable, as few people as possible should handle the sample.

Chain-of-Custody Procedures (Cont'd)

Sample Collection (Contd)

2. Stream and effluent samples should be obtained, using standard field sampling techniques.

3. The Chain-of-Custody record tag, red in color, (Exhibit I) should be attached to the sample container at the time the sample is collected and should contain the following information: sample number, time taken, date taken, source of sample (to include type of sample and name of firm), the preservative, analyses required, name of person taking sample and witnesses. The front side of the card (which has been prefilled) should be signed, timed and dated by the person sampling. The sample container should then be sealed with a preprinted, gummed seal containing our Agency designation, date and sampler's signature (Exhibit II). The seal should cover the string or wire tie of the Chain-of-Custody tag so it cannot be removed. It should also prevent the opening of the container without breaking the seal. The tags and seals must be legibly filled out in ballpoint (waterproof ink).

4. Blank samples should also be taken. Include one sample container without preservative and containers with preservatives which will be analyzed by the laboratory to exclude the possibility of container contamination.

5. A bound field notebook, or log, should also be maintained to record field measurements and other pertinent information necessary to refresh the sampler's memory in the event he later takes the stand to testify regarding his action's during the evidence gathering activity. A separate set of field notebooks should be maintained for each survey and stored in a safe place where they could be protected and accounted for at all times. A standard format (Exhibit III) should be established to minimize field entries and should include the date, time, survey, type of samples taken, volume of each sample, type of analysis, sample numbers, preservatives, sample location, field measurements such as temperature, conductivity, DO, pH, and any other pertinent information or observations. The entries should then be signed by the field sampler. The preparation and conservation of the field notebooks during the survey will be the responsibility of the survey coordinator. Once the survey is complete, field logs will be retained by the survey coordinator, or his designated representative, as a part of the permanent record.

6. The field sampler is responsible for the care and custody of the samples collected until properly dispatched to the receiving laboratory or turned over to an assigned custodian. He must assure that each container is in his physical possession or in his view at all times, or locked in such a place and manner that no one can tamper with it.

Sample Collection (Cont'd)

7. Colored slides or photographs should be taken which would visually show the outfall sample location and any water pollution to substantiate any conclusions of the investigation. Written documentation on the back of the photo should include the signature of the photographer, time, date and site location. Photographs of this nature, which may be used as evidence, should also be handled recognizing Chain-of-Custody procedures to prevent alteration.

Transfer of Custody and Shipment:

1. When turning over the possession of samples, the transferee will sign, date and time the reverse side of the Chain-of-Custody record tag. Custody transfers, if made to a sample custodian in the field, will be made for individual samples. The back side of the card (Exhibit I) "Receipt of Sample", must be filled in by the second person who takes custody. If a third person takes custody, he must fill in the second "Receipt of Sample" portion. An additional custody card must be filled in by persons who thereafter take "custody"; therefore, the number of custodians in the chain should be as few as possible. Additional cards should be numbered consecutively.

2. The field custodian or field sampler, if a custodian has not been assigned, will have the responsibility of properly packaging and dispatching samples to the proper laboratory for analysis. The "Dispatch of Sample" portion of the Chain of Custody record tag will be properly filled out, dated, and signed.

3. Samples will be properly packed to avoid breakage. Preprinted gummed seals will be utilized to seal the package so that tampering can be detected (Exhibit II).

4. All packages will be accompanied by a Sample Transmittal Sheet showing identification of the contents (Exhibit IV). The original and one copy will accompany the shipment, a copy mailed directly to the laboratory, a copy mailed to Data Management and a copy retained by the survey coordinator.

5. If sent by mail, register the package with return receipt requested. If sent by common carrier, a Government Bill of Lading should be obtained. Receipts from post offices and bills of lading will be sent to and retained by the laboratory custodians as part of the permanent Chain-of-Custody documentation.

6. If samples are delivered to the laboratory when appropriate personnel are not there to receive them, the samples must be

Chain-of-Custody Procedures (Cont'd)

Transfer of Custody and Shipment (Cont'd)

locked in a designated area within the laboratory in a manner so that no one can tamper with them. The same person must then return to the laboratory and unlock the samples and deliver custody to the appropriate custodian.

Laboratory Custody Procedures:

1. The laboratory shall designate one full-time employee as a "sample custodian". An alternate will be designated in his absence. In addition, the laboratory shall set aside a "sample storage security area". This should be a clean, dry, isolated room which can be securely locked from the outside. The custodian shall also maintain a permanent log book in which he records, for each sample, the person delivering the sample, the person receiving the sample, date and time received, source of sample, sample number, how transmitted to lab, and a number assigned to each sample by the laboratory. A standardized format should be established for log book entries.

2. All samples should be handled by the minimum possible number of persons.

3. All incoming samples shall be received only by the custodian, who will indicate receipt by signing the Sample Transmittal Sheets accompanying the samples and retaining the sheets as permanent records.

4. Immediately upon receipt, the custodian will affix a number to the attached tag, record the required information in the log book and place the sample in the sample room, which will be locked at all times except when samples are removed or replaced by the custodian. To the maximum extent possible, only the custodian should be permitted in the sample room.

5. The custodian shall ensure that heat-sensitive or light-sensitive samples, or other sample materials having unusual physical characteristics, or requiring special handling, are properly stored and maintained.

6. Only the custodian will distribute samples to personnel who are to perform tests. The custodian will enter into the log the laboratory sample number, time and date, and the signature of the person to whom given.

7. Laboratory personnel should examine the seal on the container prior to opening and should be prepared to testify that their examination of the container indicated that it had not been opened or otherwise tampered with.

Chain of Custody Procedures (Cont'd)

Laboratory Custody Procedures (Cont'd)

8. The analyst will record in his log book the name of the person from whom the sample was received, whether it was sealed, identifying information describing the sample (by origin and sample identification number), the procedures performed and the results of the testing. The notes should be signed and dated by the person performing the tests and retained as a permanent record in the laboratory. In the event that the person who performed the tests is not available as a witness at time of trial, the government may be able to introduce the notes in evidence under the Federal Business Records Act.

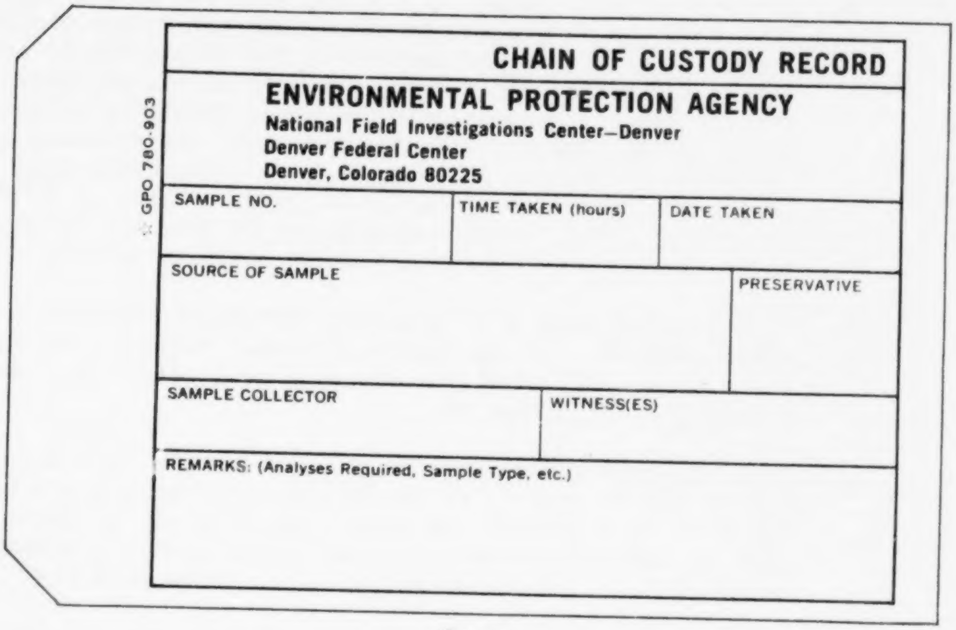
9. To the extent possible, standard methods of laboratory analyses shall be used. If laboratory personnel deviate from standard procedures, they should be prepared to justify their decision during cross-examination.

10. Laboratory personnel are responsible for the care and custody of the sample once it is handed over to them and should be prepared to testify that the sample was in their possession and view or securely locked up at all times from the moment it was received from the custodian until the tests were run.

11. Once the sample testing is completed, the unused portion of the sample, together with all identifying tags and seals, should be returned to the custodian who will make the appropriate entries in his log. The returned tagged sample will be retained in the sample room until it is required for trial. Strip charts and other documentation of work will also be turned over to the custodian.

12. Samples, tags and laboratory records of tests may be destroyed only upon the order of the laboratory director, who will first confer with the DFI Director to make certain that the information is no longer required or the samples have deteriorated.

EXHIBIT 1



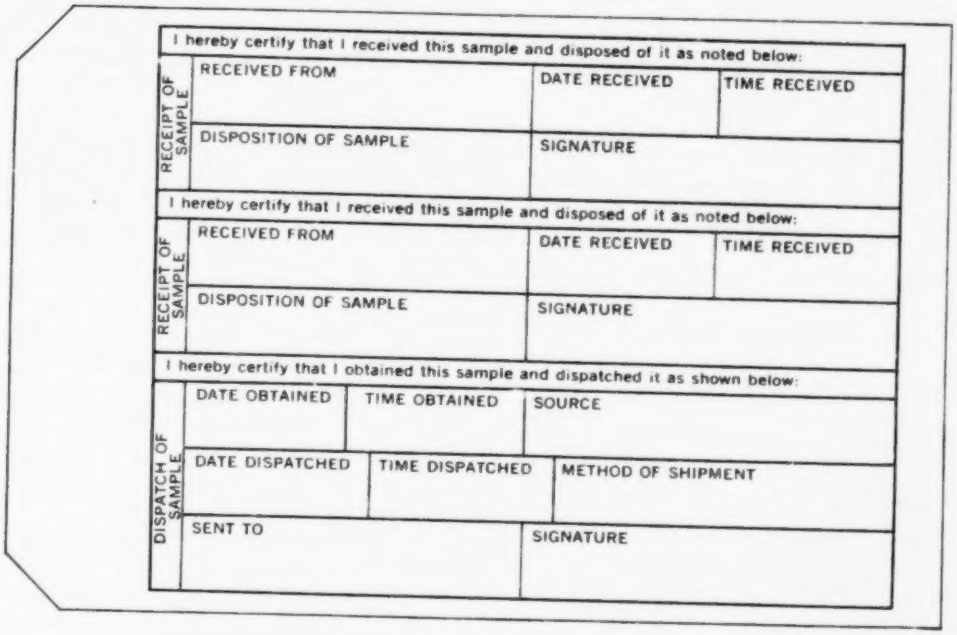
CHAIN OF CUSTODY RECORD

ENVIRONMENTAL PROTECTION AGENCY
National Field Investigations Center–Denver
Denver Federal Center
Denver, Colorado 80225

☆ GPO 780-903

SAMPLE NO.	TIME TAKEN (hours)	DATE TAKEN
SOURCE OF SAMPLE		PRESERVATIVE
SAMPLE COLLECTOR	WITNESS(ES)	
REMARKS: (Analyses Required, Sample Type, etc.)		

Front



I hereby certify that I received this sample and disposed of it as noted below:

RECEIPT OF SAMPLE	RECEIVED FROM	DATE RECEIVED	TIME RECEIVED
	DISPOSITION OF SAMPLE	SIGNATURE	

I hereby certify that I received this sample and disposed of it as noted below:

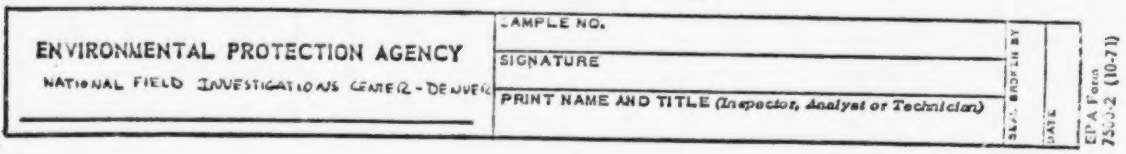
RECEIPT OF SAMPLE	RECEIVED FROM	DATE RECEIVED	TIME RECEIVED
	DISPOSITION OF SAMPLE	SIGNATURE	

I hereby certify that I obtained this sample and dispatched it as shown below:

DISPATCH OF SAMPLE	DATE OBTAINED	TIME OBTAINED	SOURCE
	DATE DISPATCHED	TIME DISPATCHED	METHOD OF SHIPMENT
	SENT TO	SIGNATURE	

Back

EXHIBIT II



ENVIRONMENTAL PROTECTION AGENCY

NATIONAL FIELD INVESTIGATIONS CENTER - DENVER

SAMPLE NO.

SIGNATURE

PRINT NAME AND TITLE *(Inspector, Analyst or Technician)*

SEAL BROKEN BY

DATE

EPA Form 7500-2 (10-71)

DATE ____________

EXHIBIT III
FIELD DATA RECORD

SAMPLER ____________
____

STATION	NUMBER	DATE	TIME	TEMPERATURE °C	CONDUCTIVITY µmhos/cm	pH S.U.	D.O. mg/l	Gage Ht. or Flow m or m^3/s

EXHIBIT III

FOR ______________________ ______________________ SURVEY, PHASE ____, DATE ______________

TYPE OF SAMPLE ______________________

					ANALYSES REQUIRED																					
STATION NUMBER	STATION DESCRIPTION	TOTAL VOLUME	TYPE CONTAINER	PRESERVATIVE	NUTRIENTS	BOD	COD	TOC	TOTAL SOLIDS	SUSPENDED SOLIDS	ALKALINITY	DO	pH*	CONDUCTIVITY*	TEMPERATURE*	TOTAL COLIFORM	FECAL COLIFORM	TURBIDITY	OIL & GREASE	METALS	BACTI	PESTICIDES	HERB	TRACE ORGANICS	PHENOL	CYANIDE
	REMARKS																									
	*Field Measurements																									

Sampler(s) ______________________

____

E-10

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement
NATIONAL FIELD INVESTIGATION CENTER– DENVER
Building 53, Room B1405, Denver Federal Center
Denver, Colorado 80225

SAMPLE TRANSMITTAL SHEET

TO:

FROM:

Sample No.	Preservative	Analysis Required

To be completed in field:

Prepared by: ______________________ Date: ______________
Signature

Field Notebook No. ______________ Time: ______________

To be completed by Laboratory:

Received by: ______________________ Date: ______________
Signature

Time: ______________

Distribution: Orig. & 1 copy – Accompany shipment
1 copy – mail directly to Laboratory
1 copy – mail to Data Management
1 copy – Survey Coordinator Field Files

PERMISSION TO SAMPLE ON COMPANY PROPERTY

The following letter was sent to all industries and municipalities involved in the Kansas City, Kansas Water Quality Survey, requesting their cooperation and assistance.

Dear Mr.

This is to confirm recent contact with you by Messrs. Barrett E. Benson and Dennis T. Cafaro of the Environmental Protection Agency (EPA) National Field Investigations Center-Denver (NFIC-D) relative to a water quality and waste source investigation which EPA plans to conduct in the Kansas City area during the period September 5 through October 15, 1972. With your permission, the liquid waste discharge(s) from your premises will be sampled during this survey.

The purpose of the survey is to collect information and water quality data which will be used as the basis for: (1) evaluation of Corps of Engineers permits as required under the River and Harbor Act of 1899; (2) determination of present water quality conditions in the Missouri and Kansas Rivers and their tributaries; (3) evaluation of the individual and collective impacts of wastewater discharges on the beneficial water uses of the Missouri and Kansas River and their tributaries; (4) determination of water pollution control needs within the area; and (5) abatement proceedings as necessary or warranted under the River and Harbor Act of 1899, the Water Quality Act of 1965, and/or other applicable local, State, and Federal laws. This means is taken to advise you that information provided by you, as well as data regarding discharges from your Company's premises, may be used as evidence against your Company in abatement proceedings under the applicable laws.

We are asking you to provide to this office by August 28, 1972, written permission for EPA representatives to conduct waste discharge sampling, analysis, and flow measurement, as may be required in the course of the investigation. We wish to assure you that any data collected on your discharge will be furnished to you upon request.

Your cooperation in the conduct of this investigation is essential to success of the Clean Water effort, and is therefore earnestly solicited.

Very truly yours,

Jerome H. Svore
Regional Administrator

BACTERIOLOGICAL DATA
MISSOURI RIVER
KANSAS CITY TO LEXINGTON
JULY 16-20, 1972

Total-and fecal-coliform bacteria and fecal streptococci samples were collected from 22 stations in the Missouri River from the ASB bridge (RM 365.5) downstream to Lexington, Missouri (RM 317). Samples collected on July 16 and 17, 1972, were influenced by rainfall. Samples collected from July 18 through 20, 1972, were not influenced by rainfall.

The enclosed table summarizes the bacteriological data; log means of bacterial densities were calculated to illustrate the effects of the rainfall.

TABLE G-1

BACTERIOLOGICAL DATA - MISSOURI RIVER
KANSAS CITY, KANSAS TO LEXINGTON, MISSOURI
JULY 16-20, 1972

Station No.	Station Description	Date Collected	Time Collected	River Mile	Total Coliforms/100 ml	Fecal Coliforms/100 ml	Fecal Streptococci/100 ml
18	Missouri River at the ASB Bridge, 1/4 distance from the south bank	0716	1040	365.5	62,000	6,400	1,100
		0717	0730		76,000	5,400	590
		0718	0920		360,000	24,000	8,200
		0719	0935		250,000	18,000	53,000
		0720	0920		87,000	10,000	7,600
	Log Mean (rain)				69,000	5,900	800
	Log Mean (combined)				130,000	11,000	4,600
	Log Mean (no rain)				200,000	16,000	15,000
19	Missouri River at the ASB Bridge, 1/2 distance from the south bank	0716	1037	365.5	31,000	3,100	1,200
		0717	0730		21,000	2,000	580
		0718	0920		49,000	7,200	4,200
		0719	0950		190,000	31,000	35,000
		0720	0920		51,000	7,900	6,000
	Log Mean (rain)				26,000	2,500	800
	Log Mean (combined)				50,000	6,400	3,600
	Log Mean (no rain)				78,000	12,000	9,600
20	Missouri River at the ASB Bridge, 3/4 distance from the south bank	0716	1035	365.5	60,000	6,300	1,000
		0716	0735		25,000	4,000	480
		0718	0925		37,000	2,900	2,900
		0719	1000		240,000	13,000	40,000
		0720	0925		57,000	8,600	7,600
	Log Mean (rain)				39,000	5,000	690
	Log Mean (combined)				60,000	6,100	3,400
	Log Mean (no rain)				80,000	6,900	9,600
23	Rock Creek, 100 m upstream into mouth	0716	0930	362.6	>8,000,000	390,000	390,000
		0716	0840		100,000,000	850,000	3,200,000
		0718	1005		18,000,000	180,000	74,000
		0719	1020		33,000,000	2,300,000	510,000
		0720	0935		360,000,000	200,000	220,000
	Log Mean (rain)				>28,000,000	580,000	1,100,000
	Log Mean (combined)				>44,000,000	520,000	400,000
	Log Mean (no rain)				60,000,000	490,000	200,000
24	Blue River, 200 m upstream into mouth	0716	0910	358.0	>8,000,000	1,100,000	460,000
		0717	0900		250,000,000	970,000	250,000
		0718	1030		35,000,000	360,000	270,000
		0719	1045		7,000,000	240,000	360,000
		0720	0955		19,000,000	360,000	16,000
	Log Mean (rain)				>45,000,000	1,000,000	340,000
	Log Mean (combined)				>25,000,000	510,000	180,000
	Log Mean (no rain)				17,000,000	310,000	120,000
25	Old Blue River Channel, 100 m upstream into mouth	0716	0900	356.7	4,500,000	130,000	480,000
		0717	0905		20,000,000	1,000,000	370,000
		0718	1040		4,900,000	41,000	470,000
		0719	1050		3,100,000	70,000	1,800,000
		0720	1005		3,600,000	74,000	81,000
	Log Mean (rain)				9,500,000	360,000	420,000
	Log Mean (combined)				5,500,000	120,000	414,000
	Log Mean (no rain)				3,800,000	60,000	410,000

TABLE G-1 (Cont.)

BACTERIOLOGICAL DATA - MISSOURI RIVER
KANSAS CITY, KANSAS TO LEXINGTON, MISSOURI
JULY 16-20, 1972

Station No.	Station Description	Date Collected	Time Collected	River Mile	Total Coliforms/100 ml	Fecal Coliforms/100 ml	Fecal Streptococci/100 ml
26	Missouri River, 1/3 distrance from the south bank	0716	0845	356.0	170,000	8,400	3,700
		0717	0915		79,000	4,500	2,000
		0718	1045		580,000	18,000	11,000
		0719	1035		330,000	24,000	46,000
		0720	1010		290,000	15,000	5,800
	Log Mean (rain)				120,000	6,100	2,700
	Log Mean (combined)				240,000	12,000	7,400
	Log Mean (no rain)				380,000	19,000	14,000
27	Missouri River, 2/3 distance from the south bank	0716	0800	356.0	130,000	5,000	2,300
		0717	0915		45,000	2,000	1,600
		0718	1050		53,000	9,000	2,600
		0719	1115		320,000		68,000
		0720	1015		160,000	6,000	7,500
	Log Mean (rain)				76,000	3,200	1,900
	Log Mean (combined)				110,000	4,800	5,500
	Log Mean (no rain)				140,000	7,300	11,000
28	Big Shoal Creek, past 1st bend	0716	0825	351.6	31,000	900	970
		0717	0930		27,000	800	220
		0718	1115		930,000	55,000	110,000
		0719	1140		480,000	69,000	>100,000
		0720	1030		37,000	800	4,900
	Log Mean (rain)				29,000	850	460
	Log Mean (combined)				110,000	4,700	>6,500
	Log Mean (no rain)				250,000	14,000	>38,000
29	Mill Creek, 100 m upstream into mouth	0716	0850	350.5	3,200	220	630
		0717	1130		61,000	3,600	750
		0718	1130		1,400,000	95,000	97,000
		0719	1200				>100,000
		0720	1100		13,000	300	300
	Log Mean (rain)				14,000	800	690
	Log Mean (combined)				63,000	2,200	>4,200
	Log Mean (no rain)				170,000	5,300	14,000
30	Missouri River, 1/3 distance from the south bank	0716	1315	345.4	210,000	21,000	12,000
		0717	1030		160,000	7,700	2,200
		0718	1150		1,100,000	23,000	19,000
		0719	1216		620,000		53,000
		0720	1115		210,000	13,000	7,700
	Log Mean (rain)				180,000	13,000	5,100
	Log Mean (combined)				340,000	15,000	12,000
	Log Mean (no rain)				520,000	17,000	20,000
31	Missouri River, 2/3 distance from the south bank	0716	1320	345.4	140,000	9,000	45,000
		0717	1030		80,000	3,800	1,200
		0718	1150		310,000	22,000	8,900
		0719	1220		250,000	12,000	33,000
		0720	1120		120,000	6,000	6,600
	Log Mean (rain)				110,000	5,800	7,300
	Log Mean (combined)				160,000	8,800	10,000
	Log Mean (no rain)				210,000	12,000	12,000

TABLE G-1 (Cont.)

BACTERIOLOGICAL DATA - MISSOURI RIVER
KANSAS CITY, KANSAS TO LEXINGTON, MISSOURI
JULY 16-20, 1972

Station No.	Station Description	Date Collected	Time Collected	River Mile	Total Coliforms/100 ml	Fecal Coliforms/100 ml	Fecal Streptococci/100 ml
32	Little Blue River, 200 m upstream from mouth	0716	1335	339.9	700	70	30
		0717	1050		280	60	50
		0718	1210		1,700	40	310
		0719	1240		54,000	11,000	83,000
		0720	1135		25,000	1,900	9,900
	Log Mean (rain)				440	65	39
	Log Mean (combined)				3,400	320	820
	Log Mean (no rain)				13,000	940	6,300
33	Missouri River, mid-channel	0716	1350	334.5	170,000	6,300	4,700
		0717	1105		89,000	6,700	2,100
		0718	1230		1,700,000	24,000	9,600
		0719	1205		2,700,000	32,000	47,000
		0720	1155		190,000	11,000	13,000
	Log Mean (rain)				120,000	6,500	3,100
	Log Mean (combined)				420,000	13,000	9,000
	Log Mean (no rain)				960,000	20,000	18,000
34	Fishing River, 200 m upstream from mouth	0716	1355	334.1	28,000	1,800	5,300
		0717	1110		15,000	600	250
		0718	1235		63,000	2,000	400
		0719	1325		410,000	39,000	>100,000
		0720	1200		21,000	4,600	12,000
	Log Mean (rain)				20,000	1,000	1,200
	Log Mean (combined)				47,000	3,300	>3,600
	Log Mean (no rain)				82,000	7,100	>7,800
35	Fire Creek, 200 m upstream from mouth	0716	1005	330.7	15,000	400	450
		0717	1125		1,100	20	190
		0718	1250		2,600	210	800
		0719	1340		>80,000		>100,000
		0720	1215		31,000	9,700	26,000
	Log Mean (rain)				4,100	89	290
	Log Mean (combined)				>10,000	360	>2,800
	Log Mean (no rain)				>19,000	1,400	>13,000
36	Missouri River, 1/3 distance from the south bank	0716	1100	327.5	17,000	8,400	3,300
		0717	1135		82,000	4,100	5,700
		0718	1210		490,000	19,000	7,800
		0719	1355		1,100,000	50,000	48,000
		0720	1225		230,000	9,000	19,000
	Log Mean (rain)				37,000	5,900	4,300
	Log Mean (combined)				180,000	12,000	11,000
	Log Mean (no rain)				500,000	20,000	19,000

TABLE G-1 (Cont.)

BACTERIOLOGICAL DATA - MISSOURI RIVER
KANSAS CITY, KANSAS TO LEXINGTON, MISSOURI
JULY 16-20, 1972

Station No.	Station Description	Date Collected	Time Collected	River Mile	Total Coliforms/100 ml	Fecal Coliforms/100 ml	Fecal Streptococci/100 ml
37	Missouri River, 2/3 distance from	0716	1105	327.5	230,000	15,000	72,000
	the south bank	0717	1140		61,000	6,200	130
		0718	1210		610,000	23,000	7,400
		0719	1355		1,000,000	32,000	44,000
		0720	1230		200,000	6,000	11,000
	Log Mean (rain)				120,000	9,600	3,100
	Log Mean (combined)				280,000	13,000	8,000
	Log Mean (no rain)				500,000	16,000	15,000
38	Sni River, 200 m upstream from	0716	1441	322.7	1,300	380	70
	the mouth	0717	1155		3,700	380	190
		0718	1330		79,000	8,700	1,200
		0719	1410		190,000	27,000	>100,000
		0720	1240		40,000	8,000	41,000
	Log Mean (rain)				2,200	380	120
	Log Mean (combined)				20,000	3,100	>2,300
	Log Mean (no rain)				84,000	12,000	>17,000
39	Little Sni Creek, 200 m upstream	0716	1455	321.2	1,300	330	170
	from mouth	0717	1200		9,500	600	600
		0718	1340		140,000	4,900	1,000
		0719	1420		450,000	>60,000	>100,000
		0720	1250		37,000	7,000	32,000
	Log Mean (rain)				3,500	440	320
	Log Mean (combined)				31,000	>3,300	>3,200
	Log Mean (no rain)				130,000	7,000	>15,000
40	Missouri River, at the Lexington	0716	1510	317.0	81,000	6,300	2,400
	water intake	0717	1215		83,000	4,300	1,200
		0718	1355		970,000	23,000	9,400
		0719	1435		790,000	49,000	21,000
		0720	1305		160,000	16,000	21,000
	Log Mean (rain)				82,000	5,200	1,700
	Log Mean (combined)				240,000	14,000	8,800
	Log Mean (no rain)				500,000	26,000	26,000
41	Missouri River, 2/3 distance from	0716	1512	317.0	93,000	9,500	4,700
	the south bank	0717	1215		68,000	3,900	2,100
		0718	1355		1,000,000	58,000	11,000
		0719	1435		810,000	29,000	40,000
		0720	1310		180,000	22,000	27,000
	Log Mean (rain)				80,000	6,100	3,100
	Log Mean (combined)				250,000	17,000	10,000
	Log Mean (no rain)				530,000	33,000	23,000

JAR TESTS, KAW POINT WASTEWATER TREATMENT PLANT

During the period October 7-12, 1972, NFIC-D personnel conducted jar tests on the influent to the Kansas City, Kansas Kaw Point WWTP. The samples were taken from the "splitter box" that feed the wastewater into the pre-aeration basins. Jar testing was initiated within an hour of the time of sample collection.

Unfortunately, the time available did not permit conducting suspended-solids and BOD determinations during the testing, but the results of the turbidity determinations indicate that a significant improvement in effluent quality could be obtained by chemical addition.

The use of polymers alone was helpful in reducing the turbidity, but the most significant results were obtained with the use of ferric chloride ($FeCl_3$), as a primary coagulant, together with the polymer. The best polymer used in conjunction with the ferric chloride was W.T. 2600, an anionic polymer manufactured by Calgon Corporation. The first two samples employing W.T. 2600 and $FeCl_3$ were carried out on a sample taken on the morning of October 12; with 5 mg/l of polymer, the turbidity was reduced to 3-4 Jackson Turbidity Units (JTU). The third test employing W.T. 2600 and $FeCl_3$ was conducted on a sample taken in the afternoon of October 12; the turbidity was only reduced to 14 JTU with 5 mg/l of polymer. In light of past experience this is not surprising because the effectiveness of polymers changes as the characteristics of the wastewater vary.

[Figure H-1 is a photograph of the jar test conducted on the morning of October 12 with 15 mg/l of $FeCl_3$ (as Fe) and varying amounts of Polymer No. 2600 (from left to right - blank, 0.3, 0.6, 1.0, 3.0 and 5.0 mg/l). The picture was taken one minute after the mixing speed had been adjusted to 5 r.p.m. Figure H-2 is a closeup of the blank and the sample containing 15 mg/l $FeCl_3$ and 5 mg/l of Polymer No. 2600 photographed 20 minutes after the speed had been adjusted to 5 r.p.m.]

Even with this short test it will not be possible to accurately predict the results of the addition of chemicals to the plant feed, but there are indications that a 75-percent reduction in suspended solids and a 50-percent reduction in BOD entering the Missouri River could be expected. These predictions are based on work, during the last week of September, preformed on the effluent of the Kaw Point WWTP. In the laboratory samples of the influent were filtered. The results [Table H-1] indicate that the average BOD removal was 13.8 percent by the plant and 53 percent by filtration. BOD removal in an efficient flocculation could be better than BOD removal by filtration because some of the soluble BOD may adsorb on the floc and settle out.

As a follow through to this testing, it is recommended that the plant staff conduct -- or have conducted, more extensive jar testing with analyses for BOD and SS as well as for turbidity. Following jar testing, the investigator should evaluate one or more chemicals or combinations of chemicals by using one of the plant primary settling tanks. The plant is ideally designed for this testing. Each primary tank is preceded by an aerated grit chamber. The chemical(s) could be added to the feed to the grit chamber which would serve as both a rapid-mix and a flocculation

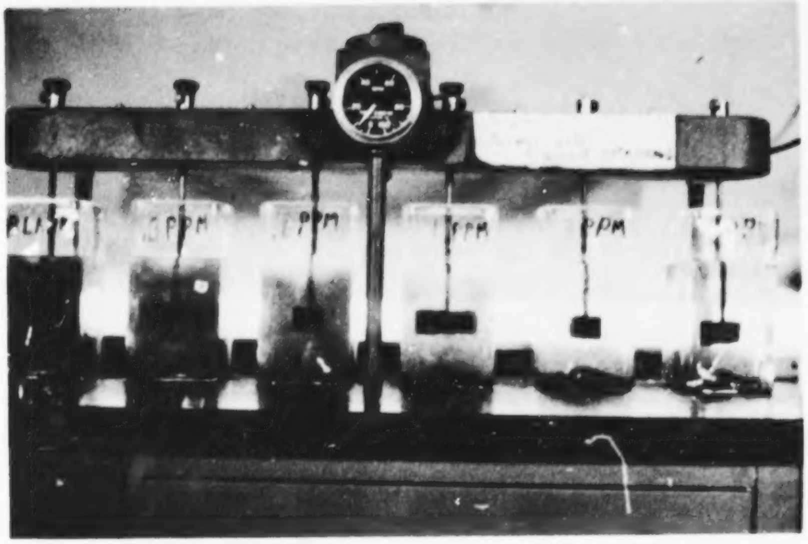


Figure H-1: Jar Tests, Untreated Influent Kaw Point Wastewater Treatment Plant.

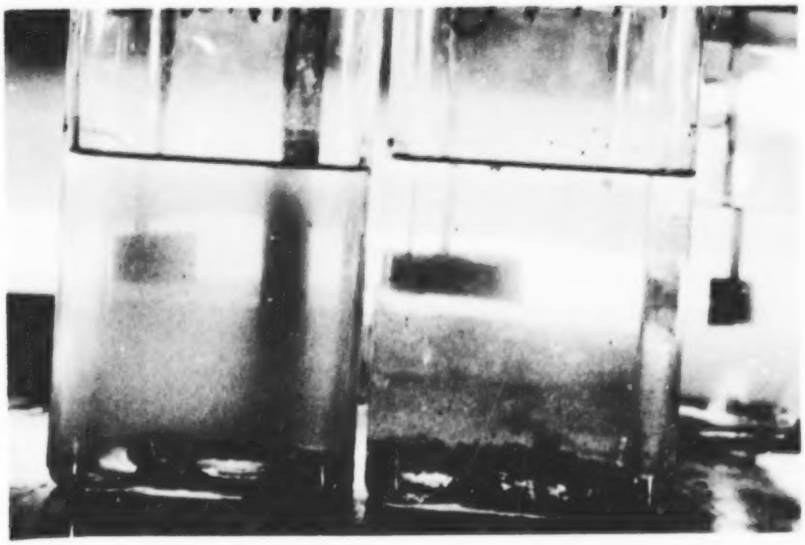


Figure H-2: Optimum Result - Jar Tests, Untreated Influent Kaw Point Wastewater Treatment Plant tank. Capital costs for both the plant testing and full-scale operation using chemicals would be minimal. Only make-up tanks, hold tanks, and feed pumps would have to be purchased. The cost of adding the chemicals found best in the jar test (15 mg/l, as Fe, of $FeCl_3$ and 5 mg/l Polymer W.T. 2600) was 2.2¢/1,000 liters (8.4¢/1,000 gal.), based on a cost of 22¢/kg (10¢/lb) for $FeCl_3$ and \$2.54/kg (\$1.15/lb) for the polymer. Calgon W.T. 2600 is one of the more expensive polymers. Further jar testing should develop a considerably less expensive combination of chemicals that will be equally effective. Improved capture of suspended solids will increase the amount of sludge to be handled, but the chemical addition could also improve the sludge-handling characteristics. A determination of the effect of chemical addition on the sludge-treatment facility will have to be made on a larger scale.

If $FeCl_3$ is selected as the coagulant to be used on a full scale, a side benefit will be removal of about 80 percent of the phosphate entering the plant. Another consideration in using $FeCl_3$ is the possibility of employing spent pickling liquor, if such is available.

CITY OF KANSAS CITY, KANSAS
WATER POLLUTION CONTROL

ORDINANCE NO. 42913

AN ORDINANCE relating to water pollution and to protect and promote the public health, safety, welfare and convenience; to establish service charges for the use of the sewer system of Kansas City, Kansas, or the discharging of sewage in Kansas City, Kansas; to provide for the collection and administration of such sewer charges, and providing penalties for the violation thereof.

BE IT ORDAINED BY THE GOVERNING BODY OF THE CITY OF KANSAS CITY, KANSAS:

SECTION I Unless the context specifically indicates otherwise, the meaning of terms used in this ordinance shall be as follows:

"SEWAGE WORKS" shall mean all facilities for collecting, pumping, treating and disposing of sewage.

"SEWAGE" shall mean a combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, together with such ground, surface, and storm waters as may be present.

"SEWER" or "SEWER SYSTEM" shall mean sanitary and storm sewers, pumping stations, sewage treatment plants, main sewers, intercepting sewers, outfall sewers, surface drains and works for the collection, transportation, pumping, treating, and disposing of water carried wastes or storm or surface waters, and all appurtenances necessary in the maintenance and operation of the same.

"PUBLIC SEWER" shall mean a sewer in which all owners of abutting properties have equal rights or is controlled by public authority.

"COMBINED SEWER" shall mean a sewer receiving both surface runoff and sewage.

"SANITARY SEWER" shall mean a sewer which carries sewage and to which storm, surface, and ground waters are not intentionally admitted.

"STORM SEWER" or "STORM DRAIN" shall mean a sewer which carries storm and surface waters and drainage, but excludes sanitary sewage and polluted industrial wastes.

"SEWAGE TREATMENT PLANT" shall mean any arrangement of devices and structures used for treating sewage.

"INDUSTRIAL WASTES" shall mean the liquid wastes from industrial processes as distinct from sanitary sewage.

"GARBAGE" shall mean solid wastes from the preparation, cooking and dispensing of food, and from the handling, storage and sale of produce.

"PROPERLY SHREDDED GARBAGE" shall mean the wastes [illegible] the preparation, cooking, and dispensing of food that have been shredded to such degree that all particles will be carried freely under the flow conditions normally prevailing in public sewers, with no particle greater than 1/2 inch in any dimension.

"STANDARD METHODS" shall mean the examination and analytical procedures set forth in the most recent edition of "Standard Methods for the Examination of Water, Sewage, and Industrial Wastes," published jointly by the American Public Health Association, the American Water Works Association and the Federation of Sewage and Industrial Wastes Associations.

"PARTS PER MILLION" or "ppm" shall mean a weight-to-weight ratio: the parts-per-million value multiplied by the factor 8.345 shall be equivalent to pounds per million gallons of water.

"B.O.D." (denoting Biochemical Oxygen Demand) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in 5 days at 20° C., expressed in parts per million by weight.

"pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

"SUSPENDED SOLIDS" shall mean solids that either float on the surface of, or are in suspension in water, sewage, or other liquids; and which are removable by laboratory filtering.

"SLUG" shall mean any discharge of water, sewage or industrial waste which, in concentration of any given constituent or in quantity of flow, exceeds for any period of longer duration than 15 minutes, more than 5 times its average hourly concentration or flow.

"UNPOLLUTED WATER or LIQUIDS" shall mean any water or liquid containing none of the following: emulsified grease or oil; acids or alkalis; substances that may impart taste-and-odor or color characteristics; toxic or poisonous substances in suspension, colloidal state

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or solution: odorous or otherwise obnoxious gases. It shall contain not more than 500 parts per million by weight of dissolved solids, and not more than 50 parts per million each of suspended solids or bio-chemical-oxygen-demand, and shall be essentially free of settleable solids. Analytical determinations shall be made in accordance with procedures set forth in "Standard Methods."

"NATURAL OUTLET" shall mean any outlet into a watercourse, pond, ditch, lake or other body of surface or ground water.

"WATERCOURSE" shall mean a channel in which a flow of water occurs, either continuously or intermittently.

"PERSON" shall mean any individual, firm, company, association, society, corporation, or group.

"SHALL" is mandatory: "MAY" is permissive.

"CLASS I" will include all sewage discharged with not more than 250 ppm of suspended solids or BOD with no matter more difficult to treat than domestic sewage, with no slugs, and where the waste is discharged throughout 24 hour day, 7 days per week. Normally, this will include all residential sewage.

"CLASS II" will include all sewage discharged with 250 to 500 ppm of either suspended solids or BOD and the waste may be discharged throughout less than 24 hours per day, 7 days per week. Normally, this will include all commercial, except those listed in Class III.

"CLASS III" will include all sewage discharged with 500 to 1,000 ppm of suspended solids or over 500 ppm of BOD and where the waste may be discharged throughout less than 24 hours per day, 7 days per week. Normally, this will include all industries in addition to laundries, restaurants, and dairy products processing establishments.

"CLASS IV" will include all sewage discharged with more than 1,000 ppm of suspended solids.

SECTION II No persons shall discharge untreated sewage in the City of Kansas City, Kansas, except into the sewer system of Kansas City, Kansas, without a special permit from the Board of Commissioners of Kansas City, Kansas, and the prior approval of the Kansas State Board of Health. No person shall discharge [illegible] in the City of Kansas City, Kansas, or into a sewage system discharging sewage in the sewer system of Kansas City, Kansas or discharge sewage in Kansas City, Kansas, without [illegible] sewer service charges as set out in Section III or Section VI hereof. Provided, however, persons who have completed plans approved by the Kansas State Board of Health for construction and maintenance of a private sewage treatment works may apply to the Board of City Commissioners of Kansas City, Kansas, for abatement of sewer service charges as set out in Sections III and VI herein. The Board of City Commissioners shall abate future sewer service charges on such application and upon the certification by the parties applying that the City need not provide treatment works capacity for their wastes. Provided further, no sewer service charge shall be made against a resident not connected to a sewer whenever the resident is not within 200 feet of a sewer.

SECTION III Rates. The following monthly rates per 100 cubic feet shall be charged all persons discharging sewage in the City of Kansas City, Kansas:

	(100 Cu. Ft.) UNITS	CLASS I	CLASS II	CLASS III
First	0-40	$ 0.~~19~~23	$ 0.~~21~~ 25	$ 0.~~23~~ 27
Next	40-100	0.~~12~~14	0.~~14~~ 17	0.~~16~~ 19
Next	100-200	0.~~10~~ 12	0.~~12~~ 14	0.14 17
Next	200-500	0.~~08~~ 10	0.~~10~~ 12	0.~~12~~ 14
Next	500-2500	0.~~06~~ 07	0.~~08~~ 10	0.~~10~~ 12
Next	2500-5000	*	0.~~06~~ 07	0.~~08~~ 10
Next	5000-10000	*	0.~~06~~ 07	0.~~07~~ 08
Over	10000-	*	0.05 06	0.~~06~~ 07
Minimum Monthly Bill		~~1.00~~ 1.20	~~1.10~~ 1.30	~~1.20~~ 1.40

CLASS IV shall have the charges applicable to CLASS III plus a surcharge at the rate of 1¢ per pound for suspended solids for concentrations over 1000 parts per million.

SECTION IV Measurement of flow. The volume of flow used for computing charges shall be the metered water consumption of the person as shown in the records of meter readings maintained by the Board of Public Utilities of Kansas City, Kansas.

If the person discharging wastes procures any part, or all, of his water from sources other than the Board of Public Utilities of Kansas City, Kansas, all or a part of which is discharged into the public sewers, the person shall install and maintain at his expense sewage meters or water meters of a type approved by the City for the purpose of determining the volume of sewage contributed or of water obtained from these other sources.

Provision for Deductions. In the event that a person discharging waste produces evidence satisfactory to the City that more than 10 per cent of the total annual volume of water used for all purposes does not reach the public sewer, then the determination of the water consumption to be used in computing the waste volume discharged into the public sewer may be made a matter of agreement between the City and the person.

SECTION V

Any person, political unit or organization discharging sewage from outside the City limits of Kansas City, Kansas, into the City sewer system or into a sewer that eventually discharges into a City sewer shall be subject to the sewer service charges as set out in Sections III and VI. It shall be the duty of such person, political unit or organization to furnish the proper metering devices to measure the volume and strength of such sewage. It shall be the duty of the person, political unit or organization to bill and collect all such charges and pay such charges directly to the City Treasurer of Kansas City, Kansas.

SECTION VI

Special rates. Notwithstanding any other provisions of this ordinance, where in the judgement of the Board of City Commissioners special conditions affecting the property of any person served by the sewer system of Kansas City, Kansas, shall exist to the extent that the charges for sewer services specified herein will result in inequitable or unfair charges for either the City of Kansas City, Kansas, or to such persons served, the Board of City Commissioners may, based upon the facts and circumstances of each individual case, change the classification or levy a special service charge in lieu of the charges hereinbefore set forth.

SECTION VII

Sanitary Sewers. No person shall cause to be discharged any storm water, surface drainage, sub-surface drainage, ground-water or roof run-off into any sanitary sewer.

Combined and storm sewers. Storm water, surface drainage, sub-surface drainage, ground water, roof run-off, cooling water or unpolluted water may be admitted to such sewers as are specifically designated as combined sewers or storm sewers and which have adequate capacity for their accommodation.

Except as hereinafter provided, no person shall discharge into the public sewers: (All laboratory analyses indicated shall be in accordance with the Standard Methods.)

(a) Inflammable or highly volatile wastes such as gasoline, cleaning solvents, fuel oil, benzene and naphtha.
(b) Ashes, sand, straw, cinders, metal and wood chips or shavings.
(c) Tars, plastics, heavy oils and other viscous materials.
(d) Free or floating mineral oil.
(e) Any solids, greases, slurries or viscous material of such character or in such quantity that may cause an obstruction to the flow in the sewer or otherwise interfere with the proper functioning of the sewage works.
(f) Feathers, hair, rags, animal hoofs or toenails, paunch manure, stomach casings, poultry entrails, poultry heads or feet, hides and fat or flesh particles not passing 1/2 inch mesh screen.
(g) Unshredded garbage or shredded garbage which will not pass a 1/2 inch mesh screen.
(h) Toxic, explosive and excessively corrosive or malodorous gases.
(i) Acetylene generation sludge.
(j) Any waste having a temperature greater than 150° F.
(k) Any waste having a pH lower than 5.0 or higher than 10.0.
(l) Any waste containing more than 2.0 ppm of cyanides as CN.
(m) Any waste containing more than 1.0 ppm of sulfides as S.
(n) Any waste containing more than a proportional amount (pro-rated on the basis of flow) of the following materials, with the limit specified as the 24 hour average concentration received at the treatment plant:

Chromium as Cr	0.25	ppm
Cyanide as CN	0.25	ppm
Copper as Cu	0.5	ppm
Nickel as Ni	0.5	ppm
Cadmium as Cd	0.5	ppm
Zinc as Zn	1.0	ppm
Lead as Pb	0.2	ppm

(o) Any toxic radioactive isotopes, with a half-life exceeding 100 days, except by special permit.

SECTION VIII No person shall maliciously, willfully or negligently break, damage, destroy, uncover, deface or tamper with any structure, appurtenance or equipment which is part of the municipal sewage works or of a private sewage system. No person shall discharge into the public sewers any matter that may cause an obstruction to the flow in the sewer or otherwise interfere with the proper functioning of the sewage works.

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SECTION IX Sewer service charge provided for in this ordinance will be based upon water meter readings of the Board of Public Utilities of Kansas City, Kansas, or meter readings approved by the Board of City Commissioners, and the strength and volume of sewage contributed, and shall be billed by the Board of Public Utilities of Kansas City, Kansas, and in accordance with the existing practice of the said Board.

Sewer service charges shall be payable at the office of the City Treasurer. The sewer service charge for CLASS I shall be billed for a two-month period. The sewer service charges shall be a debt due the City. The penalty of five percent (5%) shall be charged if the billing is not paid within ten (10) days of the rendition date. If this debt is not paid on the rendition date, it shall be deemed delinquent and may be recovered by civil action in the name of the City against the property owner, the occupant of the premises, the person charged or either of them. In the event of the failure to pay any service charges after they become delinquent, the City shall have the right to discontinue water service or to remove or close sewer connections and enter upon the property for accomplishing this purpose. The expense of such discontinuance, removal or closing, as well as the expense of restoring service shall likewise be a debt due to the City and a lien upon the property and may be recoverable by civil action in the name of the City against the property owner, the person or both. Sewer service shall not be restored until all charges, including the expense of removal, closing or restoration shall have been paid. Change of ownership or occupancy of premises found delinquent shall not be cause for reducing or eliminating these penalties.

SECTION X All monies collected by the sewer service charges herein provided for shall be deposited with the City Treasurer of Kansas City, Kansas, in a separate fund. All such monies collected shall be used to defray the expense of administering the terms and provisions of this ordinance and to plan, alter, enlarge, extend, improve, construct, reconstruct, develop, redevelop, operate and maintain the City sewer system and to pay the principal and interest on revenue bonds for the planning, altering, enlarging, extending, improving, constructing, reconstructing, developing, redeveloping, operating and maintaining the City sewer system.

SECTION XI Penalty. Any person violating any of the provisions of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not exceeding Two-Hundred Dollars ($200) or by imprisonment in the City Jail not exceeding sixty (60) days, or by both such fine and imprisonment. Each violation shall constitute a separate offense for each and every day on which such violation shall continue.

SECTION XII Severability. Each of the provisions of this ordinance is severable, and if any provision shall be declared to be invalid, the remaining provisions shall not be affected but shall remain in full force and effect.

BACTERIA SURVIVAL STUDIES

PROCEDURE

In order to determine the ability of the water in the Missouri River, and of inadequately treated sewage contained therein, to sustain bacteria, water samples were collected, in September and October of 1972, from the Missouri River (RM 367.20) downstream from the Kansas City, Kansas, WWTP discharge (RM 367.25).

Pollution indicator bacteria were studied both *in vitro* and *in situ*. The *in vitro* procedure involved initial quantitative examinations of the samples, incubation of the samples at or near the temperature of the river water, and analyses of aliquots of samples at time increments up to 72 hr. Data on *Salmonella* were obtained similarly; however, the samples were first sterilized, then inoculated with a known concentration of a pure culture of the bacteria.

The *in situ* studies involved placement of approximately 1,300 ml of river water, from the sampling point, into a sterile collodian bag* that was then suspended in the river and involved aliquots being examined quantitatively for indicator bacteria. The "entrapped" sample was re-examined after 20, 44, and 72 hr of exposure in the river.

RESULTS

In Vitro Studies

The *in vitro* study [Table J-1] disclosed that coliform bacteria

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* Collodian bags consist of cellulosic microporous material that allows smaller molecules of substances (water, minerals, and some organic materials) to penetrate; larger, more complex particles such as bacteria are retained inside the bag.

TABLE J-1

BACTERIA SURVIVAL STUDIES
MISSOURI RIVER - KANSAS CITY, KANSAS
SEPTEMBER-OCTOBER, 1972

Station Location	Initial Count/ 100 ml	Percent Remaining							
		6 hr	20 hr	24 hr	30 hr	44 hr	48 hr	54 hr	72 hr
					Total Coliforms				
Missouri River, downstream from Kansas City, Kansas, Wastewater Treatment Plant Discharge (RM 367.2)	$1.3\text{x}10^{5}$ $1.3\text{x}10^{5}$		538 65[a]			615 74[a]			654 55[a]
					Fecal Coliforms				
	$1.6\text{x}10^{4}$ $1.6\text{x}10^{4}$		119 69[a]			188 119[a]			188 47[a]
					Fecal Streptococci				
	$2.3\text{x}10^{4}$ $2.3\text{x}10^{4}$		78 61[a]			35 20[a]			30 15[a]
					Salmonella typhimurium				
	$8.2\text{x}10^{6}$	105		113	134		90	89	111
					Salmonella newport				
	$9.0\text{x}10^{6}$	96		92	92		101	103	80

[a] *In situ* studies: Samples placed in a sterile collodian bag which was then suspended in the river, and aliquots of sample were examined after selected time intervals.

contained in the sample were associated with highly favorable nutrient concentrations.

Total coliform bacteria increased, more than six-fold, during the three days of the study. Fecal-coliform bacterial densities also increased but considerably less than did the densities of total coliform bacteria. Fecal streptococci responded less to nutrient levels. These organisms showed an initial decrease followed by a gradually accelerating die-away. Densities of *Salmonella* remained relatively constant throughout the three-day survival study.

In Situ Studies

The *in situ* study results exhibit a more positive response to actual environmental conditions in the stream than did the *in vitro* studies. The bacteria are more directly exposed to constantly changing environmental conditions. Changing pH, temperatures, and toxic and nutritive substances directly affect the bacterial populations. The aquatic environment, in general, is unfavorable to these particular organisms. Total- and fecal-coliform bacterial and fecal streptococci densities decreased initially and presented a gradually accelerating die-away during the three-day *in situ* survival study.

CONCLUSIONS

The studies reveal that the enteric pathogens could survive for long periods of time and are carried over long distances in the river. The maximum flow time, from Kansas City to the intake of the Lexington, Missouri, water-treatment plant, is less than 10 hr, much less than the survival times measured in the *in vitro* and *in situ* studies. Therefore, it is concluded that a serious, potential health hazard exists in the use of Missouri River water for the Lexington, Missouri, water supply.

METHODS OF ANALYSIS

Bacteriological analyses for total and fecal coliform bacteria and fecal streptococci were performed, according to accepted methods,[1/] using the membrane filter technique. To prevent contamination, all samples were collected aseptically in sterile bottles prepared according to standard techniques.[1/]

Salmonella sampling involved placement of sterile gauze pads at selected stream locations for a five-day period. The pads were retrieved, placed in sterile plastic bags, chilled, and transported to the laboratory within three hours for analyses. There is no standard procedure for detection of *Salmonella* in surface waters. The method employed by NFIC-Denver was the elevated temperature technique of Spino[2/] with modifications. Selective enrichment media included dulcitol-selenite broth and tetrathionate broth base. Incubation temperature was 41.5°C. On each of five successive days the growth in each of the enrichment media containing the pads was streaked onto selective plating media that consisted of brilliant green and xylose-lysine-deoxycholate agars. Colonies with characteristics typical of *Salmonella* were picked and subjected to biochemical identification using a multi-test system. *Salmonella* were identified serologically and representative cultures from each location were sent to the National Center for Disease Control, Atlanta, Georgia, for serological confirmation. A one-liter sample was collected at the waste discharge of the Kansas City, Kansas, WWTP waste discharge. The sample was filtered through sterile diatomaceous earth and the "plug" analyzed for *Salmonella*.

The BOD and DO tests were conducted according to standard methods[1] using the azide modification of the Winkler method.

All other laboratory analyses and field measurements were conducted in accordance with accepted standard techniques.[3]

REFERENCES

1/ M. J. Tarus, A. E. Greenberg, R. D. Hoak, and M. C. Rand *Standard Methods for the Examination of Water and Wastewater* 13th Edition, American Public Health Association New York, New York 1971.

2/ Donald F. Spino, *Elevated-Temperature Technique for the Isolation of Salmonella from Streams* Applied Microbiology, Volume 14, Number 4 July 1966.

3/ *Methods for Chemical Analysis of Water and Wastes*, Environmental Protection Agency, National Environmental Research Center, Analytical Quality Control Laboratory Cincinnati, Ohio July 1971.

DYE STUDIES

In order to determine bacteriological sampling points for Phase I of the stream survey, NFIC-D personnel conducted a flow-pattern study from June 23 through 27, 1972, on the Missouri and Kansas Rivers. The dye employed was Rhodamine WT, 20 percent solution. A Turner Model 110 fluorometer equipped with a far-UV lamp and 546/590 filter configuration was used for tracing. The dye study was conducted a second time July 6 through 8, 1972; the latter confirmed the initial results.

Jersey Creek

Dye was released (June 26, 1972) on the surface at the pumping structure at the mouth of Jersey Creek (RM 369.0). The wind blew the dye upstream into Jersey Creek for a short distance, forming an eddy on the south bank of the creek. The dye subsequently flowed into the Missouri River and remained within 10 m of the west bank downstream to the confluence (RM 367.5) of the Kansas and Missouri Rivers. At the mouth of the Kansas River, because of the backwater effects of the Missouri River, the dye traveled around the north bank of the Kansas River and was carried upstream for approximately 15 m. The dye was then carried out of the Kansas River and into mid-channel of the Missouri River. The dye concentration was detected from the west bank to mid-channel of the Missouri River downstream to the Broadway Street Bridge (RM 366.2).

Kansas River

On June 25, 1972, dye was released on the surface across the width of the Kansas River downstream from the Missouri Pacific Railroad Bridge

(RM 367.5/0.25). First, the south edge of the dye entered the Missouri River, followed by the north edge. The dye in mid-channel of the Kansas River was the last segment to enter the Missouri River. At the Missouri-Kansas State Line (RM 367.2) the highest concentration was at the south bank. The concentration decreased to background levels at mid-channel. This pattern was traced downstream to the Broadway Street Bridge.

Turkey Creek

Turkey Creek enters the Kansas River over a dam and then through a diversion tunnel at RM 367.5/3.4. Dye was released (June 27, 1972) on the surface upstream of the dam and entered the Kansas River via the tunnel. The dye rapidly traveled outward approximately one-third of the width of the channel. Vertical stratification occurred, as very little dye was detected in the upper one-meter layer. Downstream at the East Kansas Avenue Bridge (23rd Street Bridge) (RM 367.5/2.09) the dye had mixed to mid-channel. Again, vertical stratification was evident as very little dye was detected in the top 0.3 meter of water. The dye was almost completely mixed downstream at the Union Pacific Railroad Bridge (RM 367.5/1.49).

Kansas City, Kansas, Wastewater Treatment Plant

Dye was introduced into the effluent structure (June 24, 1972) of the wastewater treatment plant; the outfall into the Missouri River is submerged. The dye was traced along the south bank (about 10 m out) downstream about 1.25 km. The dye then spread to one-fourth channel and gradually mixed to one-third channel at the Broadway Street Bridge. Vertical stratification was not evident.

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Dye was introduced into the effluent structure (June 24, 1972) of the wastewater treatment plant; the outfall into the Missouri River is submerged. The dye was traced along the south bank (about 10 m out) downstream about 1.25 km. The dye then spread to one-fourth channel and gradually mixed to one-third channel at the Broadway Street Bridge. Vertical stratification was not evident.

Kansas City, Missouri, West Side Wastewater Treatment Plant

Dye was placed (June 24, 1972) in the effluent of the primary sedimentation basin, carried to the Missouri River, a distance of approximately 0.5 km, and discharged through the submerged outfall. At the outfall the dye was detected at the south bank and traced to one-fourth channel. This condition remained constant downstream to the Broadway Street Bridge. Vertical stratification was not detected. The flow pattern was different than that of the Kansas City, Kansas, WWTP. This might be caused by barges docked upstream of the Kansas City, Missouri, outfall which could have diverted the Kansas City, Kansas, WWTP effluent towards the center of the river.

DANGERS INHERENT IN INADEQUATELY TREATED DOMESTIC SEWAGE

Inadequately treated sanitary or domestic waste contains significant populations of bacteria, viruses, and protozoa that multiply within the gastro-intestinal tract of man and which are excreted in the feces of warm-blooded animals, including humans.

Inadequately treated waste poses a health threat because of the high numbers of pathogenic bacteria and viruses whose presence is indicated by fecal coliform bacteria. Fecal coliform bacteria are that portion of the coliform group of bacteria found in the feces of man and animals.

Among the disease-producing micro-organisms indicated by the presence of fecal coliform bacteria are enteropathogenic *E. coli* (causes acute localized infections such as cystitis, oculitis, colitis, diarrhea, and septicemias which sometimes are fatal for infants and aged), *Leptospira,* (commonly known as Weils disease, characterized by jaundice and kidney hemorrhage), *Salmonella* (which causes gastro-enteritis, typhoid and paratyphoid fevers), *Shigella* (which causes bacterial dysentery), *Brucella* (which causes undulent fever), *Mycobacterium tuberculosis* (which causes tuberculosis), and *vibrio cholera* (which causes cholera). The presence of *Salmonella* also indicates a high probability of the presence of other pathogenic bacteria. Waste may also contain protozoa such as those causing amoebic dysentery.

Enteroviruses are concentrated in particulate fecal matter when waste treatment is insufficient to adequately separate the solids from wastewater. Massive numbers of virus particles can be dispelled in the waste effluent to receiving surface waters.

Enteroviruses are generally transmitted by the fecal-oral route. A very small quantity of viruses are capable of infecting a susceptible individual.

Enteroviruses are pathogenic to humans and cause a variety of diseases, including poliomyelitis, aseptic meningitis (a paralytic disease similar to paralytic polio), herpangina (a throat infection common to children), pleurodyna (an infection which causes excruciating muscular pain), myocarditis (inflammation of the heart valves), coxsackie virus infection (a disease similar to polio but without paralysis), adenovirus infection (causes common colds, respiratory disease, and rashes), and other intestinal disorders such as diarrhea.

Also, the infectious hepatitis virus may be present in sewage and cause serious liver diseases.

Such viruses have a water survival time of many months. This is especially dangerous when they are replaced and supplemented by continued discharges of waste. Additionally, viruses do not lose their virulence, although they may diminish in number.

Enteroviruses, pathogenic bacteria, and protozoa endanger not only the original host of the disease organism, but they also threaten whole communities, because the initial host may infect his family and others with whom he comes into contact. Also, these micro-organisms may increase in virulence by host passage.

TABLE N-1

KANSAS CITY, KANSAS
STREAM SURVEY LOCATIONS
July 5-20, 1972

Station Designation	Description/Location	River Mileage
01	Kansas River at Turner Memorial Bridge	367.5/9.1
02	Kansas River at 7th St Bridge, 1/3 distance from south bank	367.5/3.5
03	Kansas River at 7th St Bridge, 2/3 distance from south bank	367.5/3.5
04	Turkey Creek,upstream from mouth	367.5/3.4/1.0
05	Kansas River at Central Ave Bridge, mid-channel	367.5/1.1
06	Kansas River at I-70 Bridge, 1/4 distance from east bank	367.5/0.2
07	Kansas River at I-70 Bridge, 1/2 distance from east bank	367.5/0.2
08	Kansas River at I-70 Bridge, 3/4 distance from east bank	367.5/0.2
09	Missouri River upstream of the mouth of Kansas River, 1/3 distance from east bank	369.0
10	Missouri River upstream of the mouth of Kansas River, 2/3 distance from east bank	369.0
11	Jersey Creek upstream of mouth	368.2/1.0
12	Missouri River, downstream from the mouth of Kansas River	367.3
13	Missouri River, downstream from Kansas City, Kansas, WWTP discharge	367.25
14	Missouri River, downstream from Kansas City, Missouri, West Side WWTP discharge	366.8
15	Missouri River at Broadway Bridge, 1/4 distance from south bank	366.2
16	Missouri River at Broadway Bridge, 1/2 distance from south bank	366.2

TABLE N-1 (Cont.)

KANSAS CITY, KANSAS
STREAM SURVEY LOCATIONS
July 5-20, 1972

Station Designation	Description/Location	River Mileage
17	Missouri River at Broadway Bridge, 3/4 distance from south bank	366.2
18	Missouri River at Armour-Swift-Burlington Bridge, 1/4 distance from south bank	365.5
19	Missouri River at Armour-Swift-Burlington Bridge, 1/2 distance from south bank	365.5
20	Missouri River at Armour-Swift-Burlington Bridge, 3/4 distance from south bank	365.5
23	Rock Creek, upstream of mouth	362.6/0.1
24	Blue River, upstream of mouth	358.0/0.2
25	Old Blue River Channel, upstream of mouth	356.7/0.1
26	Missouri River, 1/3 distance from south bank	356.0
27	Missouri River, 2/3 distance from south bank	356.0
28	Big Shoal Creek, upstream of mouth	351.6/0.3
29	Mill Creek, upstream from mouth	350.5/0.1
30	Missouri River, 1/3 distance from south bank	345.4
31	Missouri River, 2/3 distance from south bank	345.4
32	Little Blue River, upstream of mouth	339.9/0.2
33	Missouri River, mid-channel	334.5
34	Fishing River, upstream of mouth	334.1/0.2
35	Fire Creek, upstream of mouth	330.7/0.2
36	Missouri River, 1/3 distance from south bank	327.5
37	Missouri River, 2/3 distance from south bank	327.5
38	Sni River upstream of mouth	322.7/0.2
39	Sni Creek upstream of mouth	321.2/0.2
40	Missouri River at Lexington Water Treatment Plant Intake	3.7.0
41	Missouri River, 2/3 distance from south bank	3.7.0

TABLE N-2

KANSAS CITY, KANSAS
SURVEY STATION IDENTIFICATION
September-October 1972

Location	Description[a]	Station Number
Kansas City, Kansas WWTP (Kaw Point)	Influent	01
	Effluent	02
Kansas City, Kansas District WWTP's		
No. 5	Influent	03
	Effluent	04
No. 6	Influent	05
	Effluent	06
No. 7	Influent	07
	Effluent	08
	100 m upstream of effluent (Kansas River)	09
	10 m downstream from effluent (Kansas River)	10
No. 8	Influent	11
	Effluent	12
	100 m upstream of effluent (Barber Creek)	13
	10 m downstream from effluent (Barber Creek)	14
No. 9A	Influent to trickling-filter plant	15
	Effluent from trickling-filter plant	16
No. 9B	Influent to aerated lagoon	17
	Effluent from oxidation pond	18
	100 m upstream of 9B effluent (Little Turkey Creek)	19
	10 m downstream from 9B effluent (Little Turkey Creek)	20
No. 20	Influent	21
	Effluent	22
	100 m upstream of effluent (Kansas River)	23
	10 m downstream from effluent (Kansas River)	24
Kansas City, Missouri West Side WWTP	Influent	25
	Effluent	26
Johnson County Main WWTP	Effluent	27

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[a] Under individual station descriptions, metric unit equivalents can be made as 1 m = 100 cm, 1.094 yd, 3.281 ft, or 39.37 in.

TABLE N-2 (Cont.)

KANSAS CITY, KANSAS
SURVEY STATION IDENTIFICATION
September-October 1972

Location	Description	Station Number
Standard Rendering	North Manhole in Shawnee Street	28
Wilson Packing	Manhole, SW corner of processing plant	29
Colgate-Palmolive	Manhole on SW corner of property (Osage Street)	30
Phillips Petroleum	Effluent outfall structure	31
Missouri River	30 m upstream of Phillips discharge (SE corner of property)	32
Missouri River	5 m downstream from Phillips discharge (SE corner of property)	33
PBI-Gordon Corp.	Effluent pipe to Kansas River	34
Kansas River	100 m upstream of PBI-Gordon discharge by-pass	35
Kansas River	10 m downstream from PBI-Gordon discharge	36
GATX	Effluent from oil separator	37
Rock Island RR	Effluent from oil separator	38
Acme Plating	Wetwell inside plant	39
Sims Barrel	Effluent from treatment-plant clarifier	40
34th St. sewer	Outfall to Kansas River	41
Osage St. sewer	Outfall to Kansas River	42
Kansas River	30 m upstream of Osage St. sewer	43
Argentine sewer	Outfall to Kansas River	44
Kansas River	30 m upstream of Argentine sewer	45
12th St. sewer	Outfall to Kansas River	46
Kansas River	30 m upstream of 12th St. sewer	47

TABLE N-2 (Cont.)

KANSAS CITY, KANSAS
SURVEY STATION IDENTIFICATION
September-October 1972

Location	Description	Station Number
Kansas River	Sewer outfall, 10 m downstream from Kansas City Southern railroad bridge, north bank	48
Kansas River	Sewer outfall, 100 m upstream of James Ave. Bridge, north bank-91.4-cm dia.	49
Kansas River	Sewer outfall, 20 m upstream of Lewis & Clark viaduct, north bank-61.0-cm dia.	50
Kansas River	Sewer outfall, 100 m downstream from 18th St. pumping station, south bank	51
Kansas River	Sewer outfall, 200 m upstream of 12th St., south bank	52
Kansas River	Sewer outfall, 350 m downstream from 12th St. Bridge, south bank	53
Kansas River	Sewer outfall, 25 m upstream of 7th Ave. Bridge, south bank (twin outfall structure)	54
Turkey Creek	Sewer outfall, 20 m downstream from 7th Ave. Bridge, north bank-61.0-cm dia.	55
Turkey Creek	2.44 m horseshoe sewer outfall, 500 m upstream of 7th Ave. Bridge, south bank	56
Turkey Creek	Sewer outfall, 900 m upstream of 7th Ave. south bank-30.5-cm dia. VCP	57
Turkey Creek	Sewer outfall, 300 m downstream from Roe Blvd. Bridge, south bank-(Penn Central discharge)	58
Unnamed Creek tributary to Turkey Creek	100 m upstream of WWTP No. 6 effluent	59

TABLE N-2 (Cont.)

KANSAS CITY, KANSAS
SURVEY STATION IDENTIFICATION
September-October 1972

Location	Description	Station Number
Unnamed Creek tributary to Turkey Creek	10 m downstream from WWTP No. 6 effluent	60
Turkey Creek	100 m upstream of Johnson County WWTP effluent	61
Turkey Creek	10 m downstream from WWTP No. 5 effluent	62
Owens-Corning Fiberglas	Manhole, Sunshine Avenue	63
Owens-Corning Fiberglas	Manhole, Fiberglas Road	64
Jersey Creek	Hidden pipe (behind rocks) behind APCO service station at 18th St. and Troup St., south bank	65
Johnson County Turkey Creek WWTP	Effluent	66
Jersey Creek	45.7-cm dia. clay pipe, 15 m upstream of 16th St. (broken inlet & outlet pipe to manhole) 6 m up south bank	67
RM 9.0[b]	left bank[c]	68
	mid-channel	69
	right bank	70
RM 8.0	left bank	71
	mid-channel	72
	right bank	73
RM 7.0	left bank	74
	mid-channel	75
	right bank	76

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[b] This designation refers to River Mile on Kansas River.

[c] Descriptions are written as one faces upstream.

TABLE N-2 (Cont.)

KANSAS CITY, KANSAS
SURVEY STATION IDENTIFICATION
September-October 1972

Location	Description	Station Number
Kansas City		
RM 6.0	left bank	77
	mid-channel	78
	right bank	79
RM 5.0	left bank	80
	mid-channel	81
	right bank	82
RM 4.0	left bank	83
	mid-channel	84
RM 3.0	left bank	86
	mid-channel	87
	right bank	88
RM 2.0	left bank	89
	mid-channel	90
	right bank	91
RM 1.0	left bank	92
	mid-channel	93
	right bank	94
RM 0.5	left bank	95
	mid-channel	96
	right bank	97
RM 3.5	7th Street Bridge, 1/3 distance from South Bank	02[d/]
RM 3.4	Mouth of Turkey Creek	04[d/]
RM 1.1	Central Ave. Bridge, mid-channel	05[d/]
RM 0.2	I-70 or Lewis & Clark Bridge, mid-channel	07[d/]

[d/] This refers to the July 5 through 20, 1972, station numbers.

TABLE N-2 (Cont.)

KANSAS CITY, KANSAS
SURVEY STATION IDENTIFICATION
September-October 1972

Location	Description	Station Number
RM 370.5[e]	Kansas City Water Intake	98
RM 368.2	Jersey Creek Mouth	11[d]
RM 367.3	Downstream from Kansas River	12[d]
RM 367.25	Downstream from Kansas City, Kansas WWTP discharge	13[d]
RM 366.8	Downstream from Kansas City, Missouri West Side WWTP discharge	14[d]
RM 366.2	Broadway Bridge, mid-channel	16[d]
RM 365.6	ASB Bridge, mid-channel	19[d]

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[d] This refers to July 5 through 20, 1972, station numbers.
[e] River Mile on Missouri River.

APPENDIX O

KANSAS CITY, KANSAS

ORDINANCE NO. 51421

ORDINANCE NO. 51421

AN ORDINANCE relating to water pollution; to protect and promote the public health, safety, welfare and convenience; to establish service charges; to regulate the discharge of sewage within Kansas City, Kansas; to provide for the collection and administration of such sewer charges; to provide penalties for the violation thereof; amending Articles I, II and III of Chapter 32 of the Code of Ordinances, City of Kansas City, Kansas; and repealing original Articles I, II and III of Chapter 32.

BE IT ORDAINED BY THE GOVERNING BODY OF THE CITY OF KANSAS CITY, KANSAS ARTICLE I - In General - Section I

DEFINITIONS. Unless the context specifically indicates otherwise, the meaning of terms used in this chapter shall be as follows:

SEWAGE WORKS shall mean all facilities for collecting, pumping, treating and disposing of sewage.

SEWAGE shall mean a combination of the water-carried wastes from residences, business buildings, institutions and industrial establishments, together with such ground, surface and storm waters as may be present.

SEWER or SEWER SYSTEM shall mean sanitary and storm sewers, pumping stations, sewage treatment plants, main sewers, intercepting sewers, outfall sewers, surface drains and works for the collection, transportation, pumping, treating and disposing of water carried wastes or storm or surface waters and all appurtenances necessary in the maintenance and operation of the same.

PUBLIC SEWER shall mean a sewer in which all owners of abutting properties have equal rights or is controlled by public authority.

COMBINED SEWER shall mean a sewer receiving both surface runoff and sewage.

SANITARY SEWER shall mean a sewer which carries sewage and to which storm, surface and ground waters are not intentionally admitted.

SEWAGE TREATMENT PLANT shall mean any arrangement of devices and structures used for treating sewage.

STORM SEWER or STORM DRAIN shall mean a sewer which carries storm and surface waters and drainage, but excludes sanitary sewage and polluted industrial wastes.

COMMERCIAL or INDUSTRIAL WASTES shall mean the liquid wastes from commercial or industrial processes as distinct from sanitary sewage.

GARBAGE shall mean solid wastes from the preparation, cooking and dispensing of food and from the handling, storage and sale of produce.

PROPERLY SHREDDED GARBAGE shall mean the wastes from the preparation, cooking and dispensing of foods that have been shredded to such degree that all particles will be carried freely under the flow conditions normally prevailing in public sewers with no particle greater than 1/2 inch in any dimension.

STANDARD METHODS shall mean the examination and analytical procedures set forth in the most recent edition of "Standard Methods for the Examination of Water, Sewage and Industrial Wastes", published jointly by the American Public Health Association, the American Water Works Association and the Water Pollution Control Federation or the most recent edition of the "Annual Book of ASTM Standards", Part 23, published by the American Society for Testing Materials.

MILLIGRAMS per LITER or MG/L shall mean a weight-to-volume ratio; the milligrams per liter value multiplied by the factor 8.345 shall be equivalent to pounds per million gallons of water.

C.O.D. (denoting Chemical Oxygen Demand) shall mean the oxygen equivalent of that portion of the material in a sample that is susceptible to oxidation by a strong chemical oxidant and expressed milligrams per liter.

B.O.D. (denoting Biochemical Oxygen Demand) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20° C expressed in milligrams per liter.

pH shall mean the logarithm of the reciprocal of the hydrogen concentration in a solution.

FILTERABLE RESIDUE shall mean solids that either float on the surface of or are in suspension in water, sewage, or other liquids; and which are removable by laboratory filtering.

SLUG shall mean any discharge of water, sewage or industrial waste which in concentration of any given constituent or in quantity of flow, exceeds for any period of longer duration than (15) minutes more than 5 times its average hourly concentration of flow.

NATURAL OUTLET shall mean any outlet into a water-course, pond, ditch, lake or other body of surface or ground water.

WATERCOURSE shall mean a channel in which a flow of water occurs, either continuously or intermittently.

PERSON shall mean any individual, firm, company, association, society, corporation, or group.

SHALL is mandatory; MAY is permissive.

CLASS I will include all sewage discharged with not more than 250 mg/l of filterable residue or B.O.D. or 375 mg/l C.O.D. with no matter more difficult to treat than domestic sewage, with no slugs.

CLASS II will include all sewage discharged with 250 to 500 mg/l of filterable residue or B.O.D. or 375 to 750 mg/l C.O.D.

CLASS III will include all sewage discharged with over 500 mg/l of filterable residue or B.O.D. or 750 mg/l of C.O.D.

UNPOLLUTED WATER OR LIQUIDS shall mean any water or liquid containing none of the following: emulsified grease or oil; acids or alkalis; subtances that may impart taste-and-odor or color characteristics; toxic or poisonous substances in suspension, colloidal state or solution; odorous or otherwise obnoxious gases. It shall contain not more than 500 parts per million by weight of dissolved solids, and not more than 50 parts per million each of suspended solids or biochemical-oxygen-demand and shall be made in accordance with procedures set forth in "Standard Methods".

POLICY Notwithstanding any other provisions of this Chapter, it is the intent of this Chapter to establish a basis of charge which fairly assesses charges to each discharger in true proportion to their contribution to the cost of treatment. Therefore the Class I, II or III designation is entirely dependent on the strength of their discharge, i.e. an industrial or commercial customer may earn the normally residential Class I by the nature of the strength level of their discharge.

ARTICLE II - Department of Water Pollution Control

Section 2. Department created to administer regulations and ordinances.

There is hereby created a water pollution control department in the city toadminister the provisions of regulations and ordinances concerning water pollution, sewage treatment, and the sewage treatment system and to operate and maintain interceptor sewers, pump stations, and treatment plants. The department shall have charge of billing and collection of sewer service charges, enforcing this article and all applicable ordinances, coordinating water pollution control between city departments, consulting engineers, industry, and private persons in the operation and maintenance of treatment facilities.

Section 3. Supervision of officers and employees of department.

The officers and employees of the water pollution control department shall work under the supervision and direction of the Board of City Commissioners. The director shall manage, control, and direct the Water Pollution Control Department. The administrative assistant shall work under the direction of the director in the billing and collecting of sewer service charges, purchasing and the administrative control of the department. The superintendent of sewage treatment shall work under the direction of the director in the operation and maintenance of the interceptor sewers, pump stations and treatment plants.

ARTICLE III - Discharge Permits

Section 4. No person shall discharge, directly or indirectly untreated sewage in the City of Kansas City, Kansas, except into the sewer system of Kansas City, Kansas, without a special discharge permit from the director and the prior approval of the Kansas State Board of Health. No person shall discharge, directly or indirectly, untreated sewage in the sewer system of Kansas City, Kansas, or use private septic or disposal tanks in the city, or discharge sewage in Kansas City, Kansas without paying the sewer service charges as set out in Article III (A) hereof. Provided, however, persons who have completed plans, approved by the Kansas State Board of Health for construction and maintenance of a private sewage treatment works may apply to the Board of City Commissioners of Kansas City, Kansas, for abatement of sewer service charges as set out in Article III herein.

Section 5. Discharge permit required - No person shall discharge wastes from any commercial or industrial establishment into the city sewers without a valid discharge permit from the director. Each discharge permit shall specify a maximum hourly and daily average pound of solids, B.O.D. and C.O.D. A new discharge permit shall be required when the limits are exceeded or the character of waste is changed from that described on existing permit. Processing fees for Discharge Permits, Temporary Discharge Permits and Renewal Discharge Permits will be based on the cost of field, laboratory and clerical expenses involved, but shall be a minimum of Ten Dollars ($10.00) for each Class II, and Twenty-Five Dollars ($25.00) for each Class III Discharge Permit.

Section 6. Any person filing an application for a discharge permit shall provide information including: the name, address and telephone number of applicant; the type of products handled or manufactured; the quantity of wastes including seasonal, weekly, daily or hourly variations; and the chemical, physical, and other characteristics of the wastes, all as requested on forms provided by the director for this purpose; and any other pertinent and necessary information.

Section 7. If, after examining the information contained in the discharge permit application, it is determined by the director that the characteristics of the proposed discharge do not conflict with the provisions of this ordinance, a discharge permit shall be issued allowing the discharge of such wastes into the city sewers. If it is determined that a proposed discharge containing materials in excess of the limitation s imposed by Section 27 of this ordinance, will not be harmful to the operation of the treatment plant, then a conditional permit may be issued.

Section 8. If it is determined by the director that the characteristics of the wastes are not in compliance with the provisions of this Ordinance, the application may be denied by the director and the applicant advised by the director of steps which must be taken to insure compliance with the provisions of this Ordinance.

Section 9. A temporary discharge permit may be granted for a period of one year to allow time for the commercial or industrial establishments to bring the waste flow into compliance with the Ordinance.

Section 10. Discharge permits may be revoked at any time if the discharge is not in compliance with the provisions of the Ordinance upon giving the holder normally thirty (30) day's written notice. The permit may be revoked by the director without thirty (30) day's written notice if the discharge has a serious deleterious effect on the sewage works, treatment processes, or constitutes a hazard to human beings, animals, or the receiving stream.

Section II. - Rates. The monthly rates are based on a charge of $0.15 per 100 cubic feet of flow, $0.02 per pound of filterable solids and $0.03 per pound of B.O.D. or $0.02 per pound of C.O.D. The C.O.D. charge shall be applied to commercial and industrial wastes when two-thirds (2/3) of the C.O.D. in mg/l exceeds the B.O.D. in mg/l.

Section I2. The following monthly rates per 100 cubic feet shall be charged all persons discharging sewage in the City of Kansas City, Kansas:

Minimum Monthly Bill - Class I - $1.80, Class II - $4.15, and Class III - $4.15.
All flow over minimum (5 ccf/mo.)

*Class I	$ .20/ccf
*Class II	$ .26/ccf
Class III	
Flow	$ .15/ccf
S.S.	$ 0.02/#
BOD	$ 0.03/#

Section I3. Class III charges over minimum shall be calculated according to the following formula:

Charge* =
($0.15 (Q) + $0.02 (Q) (S) 0.00624 + $0.03 (Q) (B.O.D.) 0.00624

or

Charge =
($0.15 (Q) + $0.02 (Q) (S) 0.00624 + $0.02 (Q) (C.O.D.) 0.00624 - if (2/3 x C.O.D.) is greater than B.O.D.

Q = Volume of Sewage in I00 cubic feet
S = Filterable Residue Concentration (mg/l)
BOD = Biochemical Oxygen Demand (mg/l)
COD = Chemical Oxygen Demand (mg/l)

* Class I and II charges utilize above formula assuming 170 and 375 mg/l, respectively, for (BOD) and (S).

Section 14. Measurement of flow. The volume of flow used for computing charges shall be the metered water consumption of the person as shown in the records of meter readings maintained by the Board of Public Utilities of Kansas City, Kansas, or in the event that an approved sewage discharge flow meter has been installed, then the measurement of flow used as the basis of charge shall be the readings of this device.

Section 15. If the person discharging wastes procures any part or all of his water from sources other than the Board of Public Utilities of Kansas City, Kansas, all or a part of which is discharged into the public sewers, the person shall install and maintain at his expense meters or water meters of a type approved by the director for the purpose of determining the volume of sewage contributed or of water obtained from these other sources.

Section 16. - Provision for Reductions: Any sewer user (whose operation involves a portion - more than 10% of his annual water consumption, that is not a waste discharge) may request that the Water Pollution Control Director make a study for the purpose of determining if a reduction would be recommended. Any recommended reduction given would be subject to the approval of the Board of City Commissioners.

Section 17. Non-Residents. Any person, political unit or organization discharging sewage from outside the City limits of Kansas City, Kansas, into the City sewer system or into a sewer that eventually discharges into a City sewer shall be subject to the sewer service charges as set out in this Article III (A). It shall be the duty of the person, political unit or organization to bill and collect all such charges and pay such charges directly to the City Treasurer of Kansas City, Kansas.

Section 18. Special rates. Notwithstanding any other provisions of this Ordinance, where in the judgment of the Board of City Commissioner's special conditions affecting the property of any person served by the sewer system of Kansas City, Kansas, shall exist to the extent that the charges for sewer services specified herein will result in inequitable or unfair charges for either the City of Kansas City, Kansas, or to such persons served, the Board of City Commissioners may, based upon the facts and circumstances of each individual case, change the classification or levy a special service charge in lieu of the charges hereinbefore set forth.

Section 19. Collections, Penalties and Discontinued Service. Sewer service charges provided for in this Ordinance will be based upon water meter readings of the Board of Public Utilities of Kansas City, Kansas, or meter readings approved by the director and the strength and volume of sewage contributed, and shall be billed by the Sewer Service Collection Department or its assigned agents.

The sewer service charges shall be a debt due the city. The penalty of five per cent

(5%) shall be charged if the billing is not paid within ten (10) days of the rendition date. If this debt is not paid on the rendition date, it shall be deemed delinquent and may be recovered by applying the deposit and/or civil action in the name of the City against the property owner, the occupant of the premises, the person charged, or either of them. In the event of the failure to pay any service charges after they become delinquent, the City shall have the right to discontinue water service or to remove or close sewer connection and enter upon the property for accomplishing this purpose. The expense of such discontinuance, removal, or closing, as well as the expense of restoring service shall likewise be a debt due to the City and a lien upon the property and may be recoverable by civil action in the name of the City against the property owner, the person or both. Sewer service shall not be restored until all charges, including the expense of removal, closing or restoration shall have been paid. Change of ownership or occupancy of premises found delinquent shall not be cause for reducing or eliminating these penalties.

Section 20. Use of Sewer Service Charges. All monies collected by the sewer service charges herein provided for shall be deposited with the City Treasurer of Kansas City, Kansas, in a separate fund. All such monies collected shall be used to defray the expense of administering the terms and provisions of this Ordinance and to plan, alter, enlarge, extend, improve, construct, reconstruct, develop, redevelop, operate and maintain the City sewer system and to pay the principal and interest on revenue bonds for the planning, altering, reconstructing, developing, redeveloping, operating and maintaining the City sewer system.

Section 21. Abatement in case of private sewage treatment works. Any person who has completed plans approved by the State Board of Health for construction and maintenance of a private sewage treatment works may apply to the Board of Commissioners for abatement of sewer service charges imposed by this article. The Board of Commissioners shall abate future sewer service charges on such application and upon the certification by the person applying that the City need not provide treatment works capacity for his wastes.

Section 22. Deposits - Required Amount.

Section 23. Deposits - Required Amount Disposition.

Section 24. Specified sewer service payments not subject to refund. Sewer service charges made prior to October 1, 1968, shall not be subject to a refund. Sewer service charges paid prior to June 1, 1971, shall not be subject to a refund after December 1, 1971. Sewer service charges paid after June 1, 1971, shall not be subject to refund on the expiration of six months after the date of payment.

ARTICLE III (B) - Water Pollution Control

Section 25. Sanitary Sewers. No person shall cause to be discharged any storm water, surface drainage, sub-surface drainage, ground water, surface drainage, ground-water or roof run-off into any sanitary sewer.

Section 26. Combined and storm sewers, storm water, surface drainage, sub-surface drainage, ground water, roof run-off, cooling water or unpolluted water may be admitted to such sewers as are specifically designated as combined sewers or storm sewers and which have adequate capacity for their accommodation.

Section 27. Except as hereinafter provided, no person shall discharge into the public sewers:

(a) Any solid, liquid or gas which by reason of its nature and/or quantity could cause fire or explosion.

(b) Any solids, natural or man-made fibers, insoluble or emulsified oils, fats, or greases, slurries or viscous material of such character or in such quantity that may cause an obstruction to the flow in the sewer or otherwise interfere with the proper functioning of the sewage works.

(c) Unshredded or shredded garbage, feathers, hair, rags, animal hoofs or toenails paunch manure, blood, stomach casings, poultry entrails, poultry heads, or feet, hides and fat or flesh particles not passing 1/2 inch mesh screen.

(d) Septic tank sludge, except that such sludge may be discharged into selected treatment plants at locations designated for this purpose by the director.

(e) Any corrosive, noxious or malodorous material or substance which, either singly or by reaction with other wastes, is capable of causing damage to the sewage works or creating a public nuisance or hazard, or prevent entry into the sewers for maintenance and repair.

(f) Any material or substance not specifically mentioned in this section which is in itself corrosive, irritating to human beings and/or animals, toxic or noxious, or which by interaction with other wastes could produce undesirable effects, including deleterious action on the sewage works, adversely affect any treatment process, constitute a hazard to human or animals, or have an adverse effect upon the receiving stream.

(g) Acetylene generation sludge.

(h) Any waste exceeding the following limits:

Temperature as ^{o}F	150
pH	Between 6.0 and 10.0
Cyanides as CN	2.0 mg/l
Sulfides as S	1.0 mg/l
Arsenic as As	2.0 mg/l
Cadmium as Cd	2.0 mg/l
Chromium as Cr	3.0 mg/l
Copper as Cu	5.0 mg/l
Lead as Pb	2.0 mg/l
Zinc as Zn	5.0 mg/l
Nickel as Ni	5.0 mg/l
Mercury as Hg	0.3 mg/l
Phenol and its Derivatives	0.1 mg/l
Surfactants	100 mg/l
Chlorinated Hydrocarbons	0.05 mg/l

Section 28. Radioactive wastes. The introduction of radioactive wastes into the City sewers shall be permitted only if a special permit is obtained prior to introducing such wastes. While each case will be decided on its own merits, in general, decisions will be in accordance with the principles laid down in the Atomic Energy Act of 1954 (68 Stat. 919), Part 20, the Sub-Part D-Waste Disposal, Section 20. 303, or successor principles as established by the Atomic Energy Commission.

Section 29. Unusual wastes. Wastes which are unusual in composition, i.e., contain an extremely large amount of suspended solids, B.O.D. or C.O.D. are high in dissolved solids such as sodium chloride, calcium chloride, or sodium sulfate, contain substances conducive to creating tastes or odors in drinking water supplies or otherwise making such water unpalatable even after conventional water purification treatment, or are in any other way unusual, shall be reviewed by the director who will determine whether such wastes shall be prohibited from or may be admitted to the City sewers or shall be modified or treated before being admitted.

Section 30. Storage of dangerous materials. The storage of any material in sewered areas or in areas draining into a City sewer which, because of discharge or leakage from such storage, may create an explosion hazard in sewage works or in any other way have a deleterious effect upon these works, treatment processes, or constitute a hazard to human beings or animals, or the receiving stream shall be subject to review by the director, who at his discretion may require reasonable safe guards to prevent discharge or leakage of large quantities of such materials into the sewers.

Section 31. Control structure. When deemed necessary by the director, the owner of any property served by a building sewer carrying commercial or industrial wastes other than normal sewage shall have installed and shall maintain at his own expense a suitable control structure or structures in the building sewers to facilitate observation sampling and measurement of each discharge. Such structures shall be constructed in accordance with plans approved by the director, and shall be located so as to permit the gauging of flow and the collection of samples truly representing the wastes leaving the property.

Section 32. Owner's permit. The owner of any establishment discharging commercial and industrial wastes to the City sewers shall submit to the director at such intervals as he may prescribe a report accurately describing the character and quantity of all such wastes other than sanitary sewage discharged to the City sewers during the period covered by the report. In order to insure compliance with this ordinance, the director may at any time take such measurements, collect such samples, and run such laboratory analyses on representative sample of any wastes as may be deemed necessary.

Section 33. Inspection authority. Any duly authorized representative of the director possessing proper credentials and identification shall be permitted to enter all properties at reasonable times for the purpose of inspection, observation, measurement, sampling and tests in accordance with the provisions of this Ordinance.

Section 34. Interference. No person shall maliciously, willfully or negligently break, damage, destroy, uncover, deface or tamper with any structure, appurtenance or equipment which is part of the municipal sewage works or of a private sewage system. No person shall discharge into the public system. No person shall discharge into the public sewers any matter that may cause an obstruction to the flow in the sewer or otherwise interfere with the proper functioning of the sewage works.

Section 35. Violations of Ordinance. Any person violating any of the provisions of this Ordinance shall be subject to a penalty not exceeding $200.00 per offense. Each 15-minute period in which the violation shall continue, shall be considered a separate offense subject to the penalty discussed herein.

In cases of repeated violations, the Director may revoke the permit for the discharge of the wastes into the sewer system, and effect the discontinuation of water or sewer service, or both. Any person violating any of the provisions of this Ordinance shall become liable to the City for any expense incurred as the result of such violation.

ARTICLE III (C) - Sewer Connections

Section 36. Within subsanitary sewer district.

Section 37. Outside subsanitary sewer district.

Section 38. When sewer connection required.

Section 39. Notice to make sewer connection.

Section 40. Septic tanks generally.

Section 41. Privies, septic tanks, etc.

Section 42. Cleaning and filling of vaults, cesspools and septic tanks.

Section 43. Unlawful discharge of sewage. It shall be unlawful for any person to permit any waste or drain from plumbing fixtures to empty into streets or alleys or be discharged on private premises.

Section 44. Enforcement of Article. It shall be the duty of the health officer to enforce the provisions of this Article III (C).

Section 45. That original Articles I, II and III of Chapter 32 of the Code of Ordinances, City of Kansas City, Kansas, be and the same are hereby repealed.

Section 46. This Ordinance shall be in full force and effect from and after its passage, approval and publication in The Kansas City Kansan, and January 1, 1973.

PASSED BY THE BOARD OF COMMISSIONERS OF THE CITY OF KANSAS CITY, KANSAS.

THIS ______________ DAY OF ______________________, 19____.

Approved:

____
Richard F. Walsh - Mayor

Attest:

____
City Clerk.

APPENDIX P

STREAM SURVEY DATA

TABLE P-1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL DATA
KANSAS AND MISSOURI RIVERS - KANSAS CITY AREA
JULY 10-15, 1972

Station No.	Description	pH Range	Conductivity umhos/cm Range	Temperature °C Range	Dissolved Oxygen mg/1 Range	Dissolved Oxygen % Samples <5 mg/1	Dissolved Oxygen % Saturation Range
01	Kansas River at Turner Memorial Bridge (RM 367.5/9.1)	8.0-8.3	740-850	25.5-27.5	6.3-9.0	0	76-112
02	Kansas River at 7th Street Bridge, 1/3 distance from south bank (RM 367.5/3.5)	7.8-8.3	740-860	26.0-28.5	4.3-7.6	20	53-93
03	Kansas River at 7th Street Bridge, 2/3 distance from south bank (RM 367.5/3.5)	7.8-8.6	700-860	26.0-28.5	4.1-7.4	40	50-94
04	Turkey Creek, upstream of mouth (RM 367.5/3.4/1.0)	7.2-7.4	1,025-1,500	22.5-26.5	3.1-6.5	60	36-80
05	Kansas River at Central Ave. Bridge, mid-stream (RM 367.5/1.1)	7.7-8.2	750-840	26.0-28.5	3.1-7.0	80	38-85
06	Kansas River at I-70 Bridge, 1/4 distance from east bank (RM 367.5/0.2)	7.2-8.4	800-875	25.5-28.0	3.5-7.1	60	43-90
07	Kansas River at I-70 Bridge, 1/2 distance from east bank (RM 367.5/0.2)	7.3-8.1	750-850	25.5-28.0	3.4-7.1	40	42-86
08	Kansas River at I-70 Bridge, 3/4 distance from east bank (RM 367.5/0.2)	7.3-8.4	750-900	25.5-29.0	3.5-7.2	40	43-91
09	Missouri River upstream of the mouth of Kansas River, 1/3 distance from east bank (RM 369.0)	7.6-8.3	625-790	23.5-25.5	5.9-7.6	0	69-88
10	Missouri River upstream of the mouth of Kansas River, 2/3 distance from east bank (RM 369.0)	7.1-8.0	650-790	23.5-26.0	5.7-7.5	0	68-87
11	Jersey Creek upstream from mouth (RM 368.2/0.1)	7.3-7.8	975-1,300	23.0-26.5	0.0-0.5	100	0-6.1
12	Missouri River, downstream from the mouth of Kansas River (RM 367.3)	7.5-8.1	625-810	24.0-27.0	5.9-7.2	0	71-85
13	Missouri River, downstream from Kansas City, Kansas, WWTP discharge (RM 367.1)	7.3-8.1	775-850	24.0-27.0	5.7-7.0	0	70-82

TABLE P-1 (Cont.)

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL DATA
KANSAS AND MISSOURI RIVERS - KANSAS CITY AREA
JULY 10-15, 1972

Station No.	Description	pH Range	Conductivity µmhos/cm Range	Temperature °C Range	Dissolved Oxygen		
					mg/1 Range	% Samples <5 mg/1	% Saturation Range
14	Missouri River, downstream from West Side (Kansas City, Missouri) WWTP discharge (RM 366.8)	6.8-8.0	650-800	24.0-27.5	5.7-8.0	0	70-94
15	Missouri River at Broadway Bridge, 1/4 distance from south bank (RM 366.2)	7.7-8.1	700-790	23.75-26.0	6.1-7.5	0	72-89
16	Missouri River at Broadway Bridge, 1/2 distance from south bank (RM 366.2)	7.7-8.1	675-775	23.5-25.5	6.4-7.4	0	76-87
17	Missouri River at Broadway Bridge, 3/4 distance from south bank (RM 366.2)	7.4-8.2	700-770	23.5-25.5	6.4-7.4	0	76-88
18	Missouri River at ASB Bridge, 1/4 distance from south bank (RM 365.5)	7.5-8.1	700-800	24.0-26.0	5.9-7.6	0	70-90
19	Missouri River at ASB Bridge, 1/2 distance from south bank (RM 365.5)	7.0-8.1	520-775	24.0-26.0	5.8-7.5	0	71-89
20	Missouri River at ASB Bridge, 3/4 distance from south bank (RM 365.5)	7.1-8.1	600-775	24.0-25.5	6.5-8.5	0	78-101

TABLE P-2

SUMMARY OF BACTERIOLOGICAL DATA
KANSAS AND MISSOURI RIVERS
KANSAS CITY, AREA
JULY 10-15, 1972

Station No.	Station Description	Total Coliforms MF Count/100 ml			Fecal Coliforms MF Count/100 ml			% Samples[a] >2000/100 ml	Fecal Streptococci MF Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum		Maximum	Log Mean	Minimum
01	Kansas River at Turner Memorial Bridge (RM 367.5/9.1)	140,000	46,000	21,000	3,900	1,400	400	40	8,600	910	260
02	Kansas River at 7th Street Bridge, 1/3 distance from south bank (RM 367.5/3.5)	53,000	35,000	17,000	4,400	2,300	800	80	3,200	700	310
03	Kansas River at 7th Street Bridge, 2/3 distance from south bank (RM 367.5/3.5)	53,000	40,000	16,000	5,400	1,700	700	40	8,600	900	270
04	Turkey Creek, upstream of the mouth (RM 367.5/3.4/0.1)	6,500,000	3,800,000	2,500,000	520,000	210,000	63,000	100	270,000	64,000	24,0
05	Kansas River at Central Avenue Bridge, mid-channel (RM 367.5/1.1)	94,000	61,000	49,000	8,200	3,800	2,100	100	6,700	1,600	480
06	Kansas River at the Interstate 70 Bridge, 1/4 distance from east bank (RM 367.5/0.2)	64,000	42,000	30,000	3,200	1,900	1,000	60	2,400	800	280
07	Kansas River at the Interstate 70 Bridge, 1/2 distance from east bank (RM 367.5/0.2)	48,000	36,000	25,000	6,200	2,500	900	60	3,200	1,000	620
08	Kansas River at the Interstate 70 Bridge, 3/4 distance from east bank (RM 367.5/0.2)	51,000	37,000	23,000	3,400	2,200	1,500	60	2,200	750	280
09	Missouri River upstream of the mouth of the Kansas River, 1/3 distance from east bank (RM 369.0)	92,000	59,000	43,000	8,500	5,600	4,200	100	5,300	2,600	510
10	Missouri River upstream of the mouth of the Kansas River, 2/3 distance from east bank (RM 369.0)	85,000	50,000	31,000	8,200	4,600	3,000	100	4,900	2,200	350

TABLE P-2 (Cont.)

SUMMARY OF BACTERIOLOGICAL DATA
KANSAS AND MISSOURI RIVERS
KANSAS CITY, AREA
JULY 10-15, 1972

Station No.	Station Description	Total Coliforms MF Count/100 ml			Fecal Coliforms MF Count/100 ml			% Samples[a/] >2000/100 ml	Fecal Streptococci MF Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum		Maximum	Log Mean	Minimum
11	Jersey Creek, upstream of the mouth (RM 368.2/1.0)	53,000,000	42,000,000	25,000,000	4,700,000	2,400,000	820,000	100	660,000	340,000	190,000
12	Missouri River, downstream from the mouth of the Kansas River (RM 367.3)	78,000	59,000	47,000	7,500	5,000	3,600	100	4,800	2,100	300
13	Missouri River downstream from the Kansas City, Kansas, WWTP discharge (RM 367.2)	22,000,000	5,400,000	1,400,000	850,000	190,000	28,000	100	540,000	110,000	9,800
14	Missouri River downstream from the West Side, Kansas City, Missouri, WWTP discharge (RM 366.8)	5,000,000	1,700,000	250,000	220,000	62,000	12,000	100	140,000	37,000	2,900
15	Missouri River at the Broadway Bridge, 1/4 distance from south bank (RM 366.2)	280,000	180,000	73,000	30,000	13,000	7,400	100	20,000	5,900	1,000
16	Missouri River at the Broadway Bridge, 1/2 distance from south bank (RM 366.2)	85,000	53,000	40,000	8,100	5,100	3,000	100	4,900	2,000	400
17	Missouri River at the Broadway Bridge, 3/4 distance from south bank (RM 366.2)	200,000	62,000	38,000	7,700	4,400	3,200	100	4,000	1,900	790
18	Missouri River at the ASB Bridge, 1/4 distance from the south bank (RM 365.6)	380,000	320,000	270,000	38,000	15,000	8,000	100	35,000	8,300	2,400
19	Missouri River at the ASB Bridge, 1/2 distance from the south bank (RM 365.6)	75,000	50,000	32,000	7,400	4,900	2,700	100	4,900	2,100	360
20	Missouri River at the ASB Bridge, 3/4 distance from the south bank (RM 365.6)	82,000	53,000	39,000	6,600	4,000	2,600	100	3,300	2,000	670

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a/ Five samples were collected.

TABLE P-3

WATER QUALITY, KANSAS RIVER, KANSAS
SEPTEMBER 18, 1972

River Mile	Station Number[a]	Time CDST	Water Depth (m)[b]	Water Temp. (°C)	Dissolved Oxygen mg/l	Dissolved Oxygen % Sat
9.0	68	0927	0.3	26	7.0	85
		0925	2.1	26	7.1	87
	69	0923	0.3	26	7.2	88
		0921	3.7	26	7.2	88
	70	0919	0.3	26	7.1	87
		0917	3.0	26	7.0	85
8.0	71	0912	0.3	26	6.9	84
		0910	1.8	26	6.9	84
	72	0907	0.3	26	6.8	83
		0905	3.4	26	6.9	84
	73	0902	0.3	26	6.9	84
		0900	4.6	26	6.9	84
7.0	74	0852	0.3	26	6.8	83
		0850	3.7	26	6.8	83
	75	0848	0.3	26	6.8	83
		0845	4.6	26	6.8	83
	76	0842	0.3	26	6.8	83
		0840	6.4	26	6.8	83
6.0	77	0830	0.3	26	6.6	81
		0825	4.5	26	6.6	81
	78	0823	0.3	26	6.9	84
		0820	3.4	26		
	79	0817	0.3	26	7.0	85
		0815	4.6	26	6.7	82
5.0	80	0802	0.3	26	6.5	79
		0759	3.0	26	6.5	79
	81	0750	7.6	26	6.6	81
		0755	0.3	26	6.7	82
	82	0745	0.3	26	6.5	79
		0740	3.7	26	6.5	79
4.0	83	0735	0.3	26	6.9	84
		0730	4.6	26	6.8	83
	84	0725	0.3	26	6.5	79
		0720	3.7	26	6.4	78
	85	0710	0.3	26	6.8	83
		0710	4.0	26	6.4	78

TABLE P-3 (Cont.)

WATER QUALITY, KANSAS RIVER, KANSAS
SEPTEMBER 19, 1972

River Mile	Station Number[a]	Time CDST	Water Depth (m)[b]	Water Temp. (°C)	Dissolved Oxygen	
					mg/l	% Sat
3.0	86	0715	0.3	27	7.3	90
		0712	4.9	27	7.2	89
	87	0710	0.3	28	7.2	91
		0709	4.3	28	7.2	91
	88	0707	0.3	28	7.0	89
		0705	2.1	28	6.9	87
2.0	89	0737	0.3		7.0	
		0735	3.6		7.0	
	90	0745	0.3	27	7.2	89
		0740	6.7	27	7.1	88
	91	0721	0.3	27	7.1	88
		0720	3.6		6.8	
1.0	92	0758	0.3		7.0	
		0756	4.0		6.8	
	93	0755	0.3	27	6.9	85
		0753	5.2	27	7.0	87
	94	0752	0.3		7.0	
		0750	3.4		6.8	
0.5	95	0815	0.3		6.6	
		0810	2.1		6.6	
	96	0809	0.3	27	6.9	85
		0807	8.2	27	7.5	93
	97	0803	0.3		7.0	
		0801	7.3		6.9	

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[a] See Appendix N for station identification.

[b] One meter is equivalent to 0.3048 feet.

TABLE P-4

WATER QUALITY, KANSAS RIVER, KANSAS
SEPTEMBER 18, 1972

River Mile	Station Number[a]	Time CDST	Water Depth (m)[b]	Water Temp. (°C)	Dissolved Oxygen		Turbidity (J.T.U.)
					mg/l	% Sat	
9.0	68	1619	0.3		7.5		
		1618	3.0		7.2		
	69	1616	0.3	26	7.5	91	190
		1613	3.4	26.5	7.2	88	200
	70	1612	0.3		7.6		
		1611	2.1		7.5		
8.0	71	1602	0.3		7.3		
		1601	1.8		7.5		
	72	1559	0.3	27	7.6	94	100
		1557	3.6	26	7.1	87	240
	73	1556	0.3		7.2		
		1554	5.5		7.7		
7.0	74	1535	0.3		7.1		
		1534	3.4		7.5		
	75	1531	0.3	27	7.2	89	140
		1530	5.2	26	7.3	89	225
	76	1527	0.3		7.6		
		1525	6.1		6.8		
6.0	77	1516	0.3		6.9		
		1515	5.2		7.0		
	78	1513	0.3	27	7.6	94	110
		1511	5.5	27	7.4	91	200
	79	1509	0.3		7.4		
		1508	4.0		7.3		
5.0	80	1458	0.3		7.0		
		1456	2.1		7.1		
	81	1455	0.3	27	7.4	91	90
		1453	4.9	27	7.3	90	250
	82	1452	0.3		7.7		
		1449	2.1		7.8		
4.0	83	1442	0.3		7.5		
		1440	3.6		7.4		
	84	1434	0.3	27	7.3	90	80
		1433	3.4		7.3		340
	85	1431	0.3		7.2		
		1426	3.6	27	7.1	88	

TABLE P-4 (Cont.)

WATER QUALITY, KANSAS RIVER, KANSAS
SEPTEMBER 19, 1972

River Mile	Station Number[a]	Time CDST	Water Depth (m)[b]	Water Temp. (°C)	Dissolved Oxygen mg/l	Dissolved Oxygen % Sat	Turbidity (J.T.U.)
3.0	86	1328	0.3		7.4		
		1327	4.0		7.1		
	87	1325	0.3	27	7.3	90	95
		1321	4.9	27	7.4	91	140
	88	1320	0.3		7.3		
		1319	3.6		7.0		
2.0	89	1341	0.3		7.1		
		1340	4.6		7.2		
	90	1338	0.3	27	8.0	99	100
		1337	6.4	27	7.3	90	140
	91	1335	0.3		7.3		
		1334	4.0		7.4		
1.0	92	1352	0.3		7.3		
		1351	3.4		7.0		
	93	1349	0.3	27	7.5	93	80
		1348	5.2	27	7.3	90	290
	94	1347	0.3		7.3		
		1345	3.6		7.5		
0.5	95	1403	0.3		7.0		
		1402	1.8		7.4		
	96	1400	0.3	27	7.0	86	90
		1359	9.1	27	7.3	90	160
	97	1358	0.3		7.7		
		1356	8.5		7.6		

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[a] See Appendix N for station identification.
[b] One meter is equivalent to 0.3048 feet.

TABLE P-[illegible]

[illegible]

KANSAS

SEPTEMBER [illegible]

River Mile[a]	9.0			8.0			7.0			6.0			5.2	5.0			4.0			3.0			2.0			1.0			0.5		
Organisms / Station No.	68	69	70	71	72	73	74	75	76	77	[illegible]	79	80A	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Annelida																															
Oligochaeta	432[b]	16	332	84	100	96	192	12	104	463	436	104	244	56	84	264	1312	116	1448	1644	300	2132	816	224	1712	636	932	660	1108	208	296
Arthropoda																															
Crustacea																															
Amphipoda																															
Hyalella azteca																															Q
Insecta																															
Hemiptera																															
Belostoma																									Q						
Neocorixa			Q[c]																												
Plea			Q										Q																		
Rhagovelia			Q																												
Trepobates			Q																												
Trichorixa										Q		Q	Q																		
Odonata																															
Argia			Q			Q	Q		Q	Q		Q					Q			Q			Q		Q	Q			Q		Q
Ischnura													Q																		
Dromogomphus						Q										Q															
Gomphoides																Q															
Gomphus			Q														Q		Q	Q		Q	Q					Q			
Macromia			Q																												
Ephemeroptera																															
Baetis			Q			Q	Q		Q	Q		Q	Q						Q												
Caenis			Q																												
Heptagenia																Q															
Hexagenia			40			Q				12		8	4			Q	Q		Q												
Stenonema			Q			Q	Q		Q	Q		Q	Q	Q		Q	Q		Q	Q		Q	Q		Q	Q		Q	Q		Q
Plecoptera																															
Neoperla			Q																												
Megaloptera																															
Corydalus cornutus			Q																												
Trichoptera																															
Cheumatopsyche			Q				Q		Q																						
Hydropsyche			Q				Q		Q	Q		Q					Q		Q	Q		Q				Q					Q
Macronemum																	4														
Mystacides						Q										Q															
Potamyia																			Q												
Leptoceridae			Q																												

TABLE P-5 (Cont.)

BENTHOS-KANSAS RIVER
KANSAS
SEPTEMBER 1972

River Mile	9.0			8.0			7.0			6.0			5.2	5.0			4.0			3.0			2.0			1.0			0.5		
Station No.[a]	68	69	70	71	72	73	74	75	76	77	78	79	80A	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Organisms																															
Arthropoda																															
Insecta																															
Diptera																															
Culcidae																															
Chaoborus				8											4																
Chironominidae																															
Ablabesmyia			4																												
Chironomus						Q	Q		Q								8		4				Q		4	Q		Q			
Coelotanypus			4	4															4			Q									
Cricotopus																	Q		Q												
Cryptochironomus			8		4	Q	Q			12		4				4			Q				Q		8						Q
Dicrotendipes																	Q														
Endochironomus							Q		Q	Q		Q								Q									Q		
Glyptotendipes										Q		Q																			
Pentaneura	4																														
Polypedilum	8		Q		4	Q	Q		Q	Q		Q	Q			Q	Q		Q	Q						Q		Q	Q		Q
Rheotanytarsus			Q																												
Tanytarsus			Q																												
Ceratopogonidae			4																												
Empididae																															
Hemerodromia			Q																												
Coleoptera																															
Dytiscidae																	Q								Q						
Elmidae						Q				Q		Q								Q											
Narpus																	Q														
Stenelmis			Q																												
Gyrinidae						Q							Q			Q			Q			Q									
Dineutus																															Q
Mollusca																															
Gastropoda																															
Lymnaea										Q																Q					
Physa							Q		Q	Q		Q	Q							Q			Q			Q		Q	Q		
Pelecypoda																															
Musculium																														4	
TOTAL NO. KINDS	3	1	26	3	3	12	11	1	10	14	1	13	10	2	2	10	13	1	13	9	1	6	7	1	7	8	1	6	6	2	8
TOTAL NO./FT^2[b]	444	16	392	96	108	96	192	12	104	492	436	116	248	56	88	268	1324	116	1456	1644	300	2132	816	224	1724	636	932	660	1108	212	296

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a/ See Appendix N for station identification.

b/ Indicates no./ft^2. However, no./m^2 is obtained by multiplying no./ft^2 by a factor of 10.76.

c/ Q = Organisms collected qualitatively; included in the number of kinds only.

TABLE P-6
PHYSICAL AND CHEMICAL CHARACTERIZATION OF SEDIMENTS
KANSAS RIVER, KANSAS
SEPTEMBER 1972

River Mile	Station Number[a]	Physical Description	Chemical Character Org. Carbon % dry wt.	Chemical Character Org. Nitrogen % dry wt.
9.0	68	Silt, buff to light tan, well sorted, very slightly clayey. Rare grains of fine to very fine sand.	0.51	0.09
	69	Sand, coarse to very coarse, subrounded, well sorted, buff to white, composed largely of quartz with minor amounts of felspar. Some iron oxide coating on grains. A few very fine gravel, composed of felspar and clastic fragments.		
	70	Sand, medium to fine, with occasional coarse-to-very coarse grains. Buff to light tan, subangular to subrounded, medium to well shorted. Approximately 5 percent silt. Clastic fragments and frosted quartz grains are subrounded to rounded, while clear quartz grains are subangular to angular.		
8.0	71	Clay, very silty, light gray, poor-to-medium sorting.		
	72	Clay, silty, medium gray, expands when wetted. Contains occasional mica flakes of medium to fine sand in size.		
	73	Clay, silty, light gray, medium sorted. Clay is expansive when wetted.		

TABLE P-6 (Cont.)
PHYSICAL AND CHEMICAL CHARACTERIZATION OF SEDIMENTS
KANSAS RIVER, KANSAS
SEPTEMBER 1972

River Mile	Station Number[a/]	Physical Description	Chemical Character	
			Org. Carbon % dry wt.	Org. Nitrogen % dry wt.
7.0	74	Clay, silty, light to medium gray, with a tan color component. Medium sorted, with no visible sand grains.		
	75	Sand, fine to very fine, silty, medium sorted, subrounded to subangular. Grains are light gray to buff, predominately quartz with minor amounts of felspar and clastic fragments. A few mica flakes. Clastic fragments, felspar and frosted quartz grains are more rounded than nonfrosted quartz grains. Occasionally angular, tabular crystals of clear to light gray amphibole.	0.31	0.08
	76	Silt, clayey, light gray, medium sorted. Clay is expansive when wetted.		
6.0	77	Silt, slightly clayey, light tan to buff, well sorted. Rare grains of fine to very fine sand.	0.85	0.08
	78	Sand, fine to very fine, light gray, with minor amounts of medium to coarse sand and silt. Poorly sorted, subangular to subrounded.		
	79	Silt, light tan to buff, very slightly clayey, with approximately two percent medium, subrounded to rounded sand grains.		

TABLE P-6 (Cont.)
PHYSICAL AND CHEMICAL CHARACTERIZATION OF SEDIMENTS
KANSAS RIVER, KANSAS
SEPTEMBER 1972

River Mile	Station Number[a/]	Physical Description	Chemical Character Org. Carbon % dry wt.	Chemical Character Org. Nitrogen % dry wt.
5.0	80	Clay, silty, light gray, medium to well sorted, with a few mica flakes of sand size. Noticeable amount of oily material in the sediment.	2.29	0.19
	81	Sand, coarse to fine, subangular to subrounded, poorly sorted. Grains are mostly quartz with minor amounts of biotite mica, felspar, and black havy materials. Minor amounts of silt. Color is light gray to buff.		
	82	Silt, slightly clayey, very slightly sandy, light tan to light gray, well sorted.		
4.0	83	Clay, silty, slightly sandy, light gray. Slightly expansive when wetted.	1.69	0.19
	84	Silt, light gray, slightly clayey, well-sorted, also contains approximately five-to-ten percent very coarse sand, subrounded, composed of predominately clastic fragments and frosted quartz grains. Two distinct suites of sediments.		
	85	Silt, well-sorted, light tan to buff. No significant sand or clay.		

TABLE P-6 (Cont.)
PHYSICAL AND CHEMICAL CHARACTERIZATION OF SEDIMENTS
KANSAS RIVER, KANSAS
SEPTEMBER 1972

River Mile	Station Number[a/]	Physical Description	Chemical Character Org. Carbon % dry wt.	Chemical Character Org. Nitrogen % dry wt.
3.0	86	Clay, silty, light tan to light gray, medium to well-sorted.	1.81	0.18
	87	Clay, slightly silty, medium to dark gray, expansive when wet. Contains approximately 10 percent very coarse sand to very fine gravel, rounded, composed of predominately clastic fragments, appears to be two distinct suites of sediment, as where a clay stream receives minor inflow from sand-bed stream.		
	88	Silt, slight tan, slightly clayey, silt grains are often largely two dimensional, very thin in relation to diameter.		
2.0	89	Clay, silty, medium sorted, gray, with numerous twigs and organic material.	2.91	0.28
	90	Sand, very coarse, with numerous very fine gravel. Medium to well sorted, subangular to subrounded. Grains are about 50 percent quartz, 50 percent clastic fragments. Clastic fragments and a few frosted quartz grains are more rounded than the subangular quartz grains.		
	91	Silt, clayey, slightly sandy, light gray, medium sorted. Sand is fine to very fine, with a few mica flakes.		

TABLE P-6 (Cont.)
PHYSICAL AND CHEMICAL CHARACTERIZATION OF SEDIMENTS
KANSAS RIVER, KANSAS
SEPTEMBER 1972

River Mile	Station Number[a]	Physical Description	Chemical Character	
			Org. Carbon % dry wt.	Org. Nitrogen % dry wt.
1.0	92	Silt, buff to very light tan, well sorted, very slightly clayey.		
	93	Clay, light gray, slightly silty, expansive when wetted.		
	94	Silt, light gray, well sorted, subangular to subrounded, with minor amounts of fine to very fine sand. Slightly clayey.	1.51	0.19
0.5	95	Clay, slightly silty, medium gray, medium to well sorted.	1.81	0.24
	96	Sand, medium to coarse, slightly silty, subangular, medium to well sorted, light gray to buff. Grains are composed of approximately two-thirds quartz and one-third felspar and clastic fragments. Clastic fragments are more rounded than quartz grains.		

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[a] See Appendix N for station identification.

TABLE P-7 (Cont.)

SUMMARY OF BACTERIOLOGICAL ANALYSES
MISSOURI RIVER AND TRIBUTARIES
KANSAS CITY, MISSOURI TO LEXINGTON MISSOURI
JULY 16-20, 1972

Station No.	Station Description	Total Coliforms MF Count/100 ml			Fecal Coliforms MF Count/100 ml			% Samples[a/] >2000/100 ml	Fecal Streptococci MF Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum		Maximum	Log Mean	Minimum
32	Little Blue River, upstream of mouth (RM 339.9/0.2)	54,000	3,400	280	11,000	320	40	20	83,000	820	30
33	Missouri River, mid-channel (RM 334.5)	2,700,000	420,000	89,000	32,000	13,000	6,300	100	47,000	9,000	2,100
34	Fishing River, upstream of mouth (RM 334.1/0.2)	410,000	47,000	15,000	39,000	3,300	600	40	>100,000	>3,600	250
35	Fire Creek, upstream of mouth (RM 330.7/0.2)	>80,000	>10,000	1,100	9,700	360	20	20[b/]	>100,000	>2,800	190
36	Missouri River, 1/3 distance from the south bank (RM 327.5)	1,100,000	180,000	17,000	50,000	12,000	4,100	100	48,000	11,000	3,300
37	Missouri River, 2/3 distance from the south bank (RM 327.5)	1,000,000	280,000	61,000	32,000	13,000	6,000	100	72,000	8,000	130
38	Sni River, upstream of the mouth (RM 322.7/0.1)	190,000	20,000	1,300	27,000	3,100	380	60	>100,000	>2,300	70
39	Little Sni Creek, upstream of mouth (RM 321.2/0.2)	450,000	31,000	1,300	>60,000	>3,300	330	60	>100,000	>3,200	170
40	Missouri River at the Lexington Water Treatment Plant Intake (RM 317.0)	970,000	240,000	81,000	49,000	14,000	4,300	100	91,000	8,800	1,200
41	Missouri River, 2/3 distance from the south bank (RM 317.0)	1,000,000	250,000	68,000	58,000	17,000	3,900	100	40,000	10,000	2,100

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a/ Five samples were collected.
b/ Four samples were collected.

TABLE P-7

SUMMARY OF BACTERIOLOGICAL ANALYSES
MISSOURI RIVER AND TRIBUTARIES
KANSAS CITY, MISSOURI TO LEXINGTON MISSOURI
JULY 16-20, 1972

Station No.	Station Description	Total Coliforms MF Count/100 ml			Fecal Coliforms MF Count/100 ml			% Samples[a] >2000/100 ml	Fecal Streptococci MF Count/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum		Maximum	Log Mean	Minimum
18	Missouri River at the ASB Bridge, 1/4 distance from the south bank (RM 365.6)	360,000	130,000	62,000	24,000	11,000	5,400	100	53,000	4,600	590
19	Missouri River at the ASB Bridge, 1/2 distance from the south bank (RM 365.6)	190,000	50,000	21,000	31,000	6,400	2,000	80	35,000	3,600	580
20	Missouri River at the ASB Bridge, 3/4 distance from the south bank (RM 365.6)	240,000	60,000	25,000	13,000	6,100	2,900	100	40,000	3,400	480
23	Rock Creek, upstream of mouth (RM 362.6/0.1)	360,000,000	>44,000,000	>8,000,000	2,300,000	520,000	180,000	100	3,200,000	400,000	74,000
24	Blue River, upstream of mouth (RM 358.0/0.2)	250,000,000	>25,000,000	7,000,000	1,100,000	510,000	240,000	100	460,000	180,000	16,000
25	Old Blue River Channel upstream of mouth (RM 356.7/0.1)	20,000,000	5,500,000	3,100,000	1,000,000	120,000	41,000	100	1,800,000	410,000	81,000
26	Missouri River, 1/3 distance from the south bank (RM 356.0)	580,000	240,000	79,000	24,000	12,000	4,500	100	46,000	7,400	2,000
27	Missouri River, 2/3 distance from the south bank (RM 356.0)	320,000	110,000	45,000	9,000	4,800	2,000	75[b]	68,000	5,500	1,600
28	Big Shoal Creek, upstream of mouth (RM [illegible])	930,000	110,000	27,000	69,000	4,700	800	40	110,000	>6,500	220
29	Mill Creek, upstream of mouth (RM 350.5/0.1)	1,400,000	63,000	3,200	95,000	2,200	220	50[b]	>100,000	>4,200	300
30	Missouri River, 1/3 distance from the south bank (RM 345.4)	1,100,000	340,000	160,000	23,000	15,000	7,700	100[b]	53,000	12,000	2,200
31	Missouri River, 2/3 distance from the south bank (RM 345.4)	310,000	160,000	80,000	22,000	8,300	3,800	100	45,000	10,000	1,200

TABLE P-8

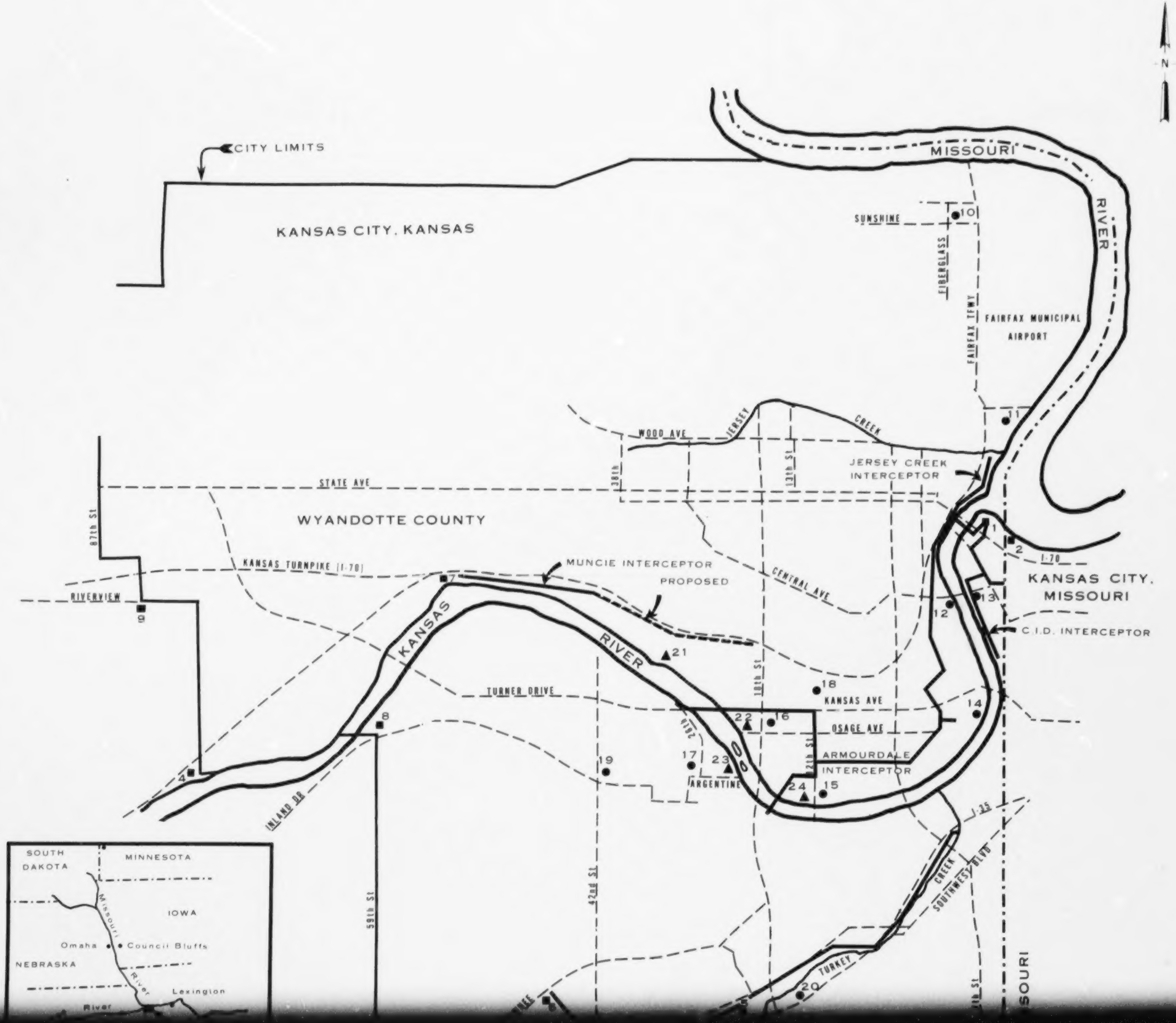
SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL DATA
MISSOURI RIVER - KANSAS CITY AREA TO LEXINGTON, MISSOURI
JULY 16-20, 1972

Sta. No.	Description	pH Range	Conductivity µmhos/cm Range	Temperature °C Range	Dissolved Oxygen		
					mg/1 Range	% Samples <5 mg/1	% Saturation Range
18	Missouri River at ASB Bridge, 1/4 distance from south bank (RM 365.5)	7.3-8.1	600-725	24.5-25.0	5.3-6.6	0	63-78
19	Missouri River at ASB Bridge, 1/2 distance from south bank (RM 365.5)	7.4-8.2	650-750	24-25.5	5.9-6.6	0	62-78
20	Missouri River at ASB Bridge, 3/4 distance from south bank (RM 365.5)	7.8-8.3	650-750	24-25.5	5.2-6.8	0	61-82
23	Rock Creek, 100 m upstream into mouth (RM 362.6/0.1)	5.4-7.4	400-1,100	23-29	0.0-5.3	80	0-62
24	Blue River, 200 m upstream into mouth (RM 358.0/0.2)	7.1-7.6	260-975	22.6-25	0.0-5.1	80	0-58
25	Old Blue River Channel, 100 m upstream into mouth (RM 356.7/0.1)	7.2-7.9	220-900	23-26	0.0-6.3	80	0-72
26	Missouri River, 1/3 distance from south bank (RM 356.0)	7.6-7.9	650-760	23-26	4.8-6.7	40	57-79
27	Missouri River, 2/3 distance from south bank (RM 356.0)	7.4-8.1	675-750	23.5-25.5	4.7-7.0	20	56-84
28	Big Shoal Creek, past first bend (RM 351.6/0.3)	5.2-8.0	190-750	22-28.5	2.2-6.0	80	26-68
29	Mill Creek, 100 m upstream into mouth (RM 350.5/0.1)	7.2-7.9	280-710	22-30	4.2-7.1	20	59-82
30	Missouri River, 1/3 distance from south bank (RM 345.4)	7.5-7.7	650-750	25-26	4.5-6.3	20	54-77
31	Missouri River, 2/3 distance from south bank (RM 345.4)	7.6-7.9	650-750	25-26	5.5-6.6	0	65-80
32	Little Blue River, 200 m upstream of mouth (RM 339.9/0.2)	7.4-8.3	240-800	24.5-27.5	2.9-10.5	40	35-131
33	Missouri River mid-channel (RM 334.5)	7.5-8.0	640-750	25-26	4.3-6.4	40	51-78

TABLE P-8 (Cont.)

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL DATA
MISSOURI RIVER - KANSAS CITY AREA TO LEXINGTON, MISSOURI
JULY 16-20, 1972

Sta. No.	Description	pH Range	Conductivity µmhos/cm Range	Temperature °C Range	Dissolved Oxygen mg/l Range	Dissolved Oxygen % Samples <5 mg/l	Dissolved Oxygen % Saturation Range
34	Fishing River, 200 m upstream of mouth (RM 334.1/0.2)	7.0-7.9	200-725	23-27	4.1-11.0	40	47-131
35	Fire Creek, 200 m upstream of mouth (RM 330.7/0.2)	7.1-8.0	140-520	24-30	4.2-7.7	20	55-94
36	Missouri River, 1/3 distance from south bank (RM 327.5)	7.2-7.8	675-800	25-26	4.4-6.5	20	52-79
37	Missouri River, 2/3 distance from south bank (RM 327.5)	7.4-8.0	600-750	25-26	4.4-6.8	40	52-83
38	Sni River, 200 m upstream of mouth (RM 322.7/0.2)	7.6-8.1	200-750	25.5-29	3.5-7.0	60	42-85
39	Little Sni Creek, 200 m upstream of mouth (RM 321.2/0.2)	7.7-8.1	190-750	23.5-27	1.3-10.8	40	16-133
40	Missouri River at Lexington water intake (RM 317.0)	7.4-8.0	650-800	25-26	3.9-6.3	20	46-77
41	Missouri River, 2/3 distance from south bank (RM 317.0)	7.2-8.1	650-825	25-26	3.0-6.4	60	36-77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CITY LIMITS
KANSAS CITY, KANSAS
MISSOURI RIVER
SUNSHINE
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FIBERGLASS
FAIRFAX TFWY
FAIRFAX MUNICIPAL AIRPORT
11
WOOD AVE
JERSEY CREEK
13th St
38th
JERSEY CREEK INTERCEPTOR
STATE AVE
WYANDOTTE COUNTY
87th St
KANSAS TURNPIKE (I-70)
MUNCIE INTERCEPTOR
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C.I.D. INTERCEPTOR
RIVERVIEW
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7
KANSAS RIVER
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18th St
18
KANSAS AVE
TURNER DRIVE
14
22
16
OSAGE AVE
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26th
17
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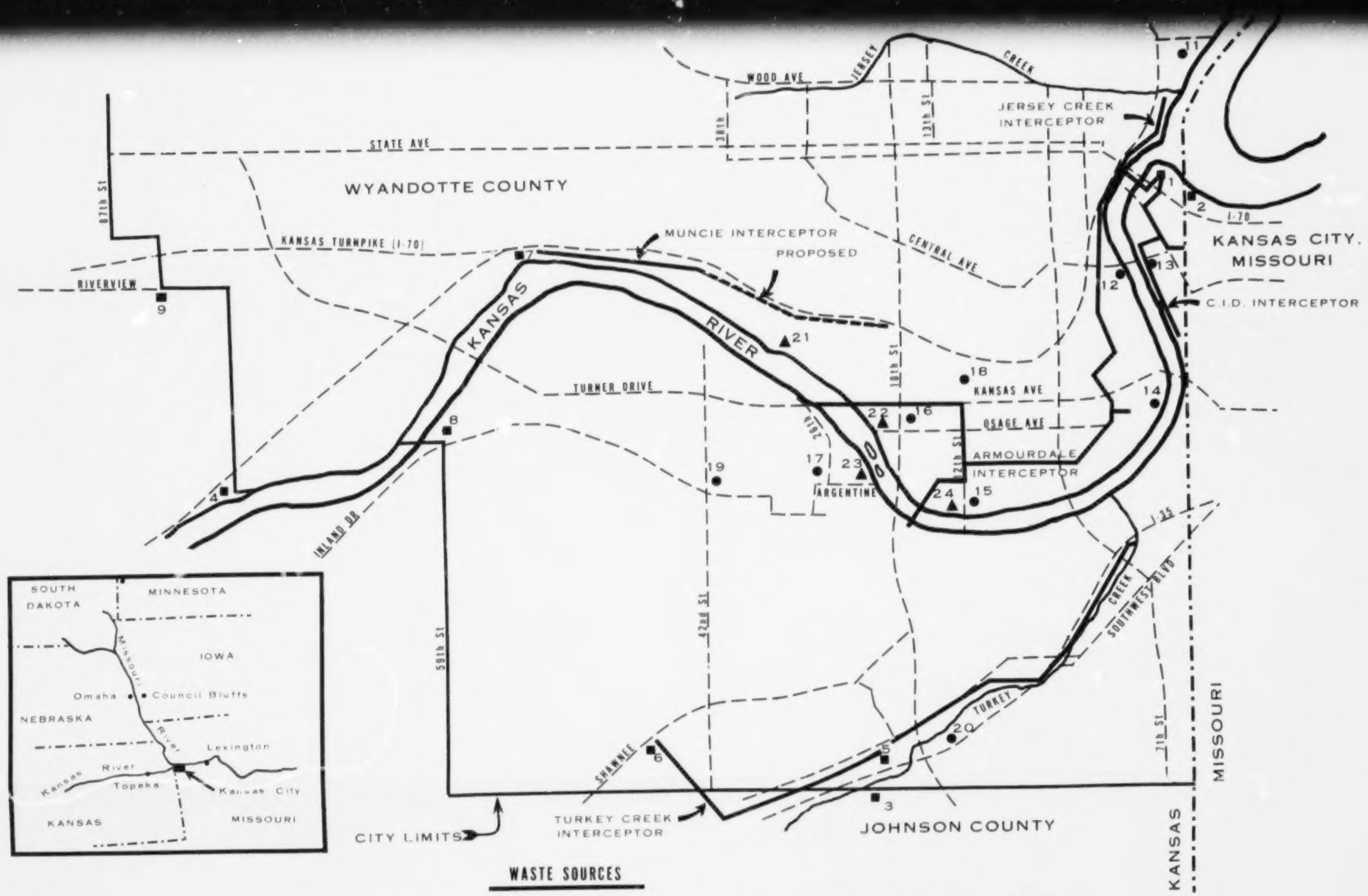
12th St
ARMOURDALE INTERCEPTOR
19
ARGENTINE
24
15
4
INLAND DR
59th St
42nd St
I-35
TURKEY CREEK
SOUTHWEST BLVD
20
MISSOURI
SOUTH DAKOTA
MINNESOTA
IOWA
Missouri
Omaha
Council Bluffs
NEBRASKA
River
Lexington
River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JERSEY CREEK INTERCEPTOR
WYANDOTTE COUNTY
87th St
KANSAS TURNPIKE (I-70)
RIVERVIEW
MUNCIE INTERCEPTOR
PROPOSED
CENTRAL AVE
KANSAS CITY, MISSOURI
I-70
C.I.D. INTERCEPTOR
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INLAND DR
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42nd St
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CREEK
SOUTHWEST BLVD
TURKEY
7th St
SHAWNEE
TURKEY CREEK INTERCEPTOR
CITY LIMITS
JOHNSON COUNTY
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SOUTH DAKOTA
MINNESOTA
IOWA
Omaha
Council Bluffs
NEBRASKA
Missouri
River
Lexington
Kansas
River
Topeka
Kansas City
KANSAS
MISSOURI

WASTE SOURCES

■ MUNICIPAL TREATMENT PLANTS

1. KAW POINT
2. WEST SIDE (K.C. MO.)
3. JOHNSON COUNTY
4. K.C.K. #20
5. K.C.K. #5
6. K.C.K. #6
7. K.C.K. #7
8. K.C.K. #8
9. K.C.K. #9

● INDUSTRIAL SOURCES

10. OWENS-CORNING FIBERGLASS
11. PHILLIPS PETROLEUM
12. P.B.I.-GORDON
13. WILSON PACKING
14. STANDARD RENDERING
15. SIMS BARREL
16. COLGATE-PALMOLIVE
17. ACME PLATING
18. ROCK ISLAND RAILROAD
19. GENERAL AMERICAN TRANSPORTATION CORP
20. PENN-CENTRAL

▲ MUNICIPAL INTERCEPTOR SEWERS

21. 34th St. OUTFALL
22. OSAGE St. OUTFALL
23. ARGENTINE OUTFALL
24. 12th St. OUTFALL

NOT TO SCALE

Figure 1. Study Area, Kansas City, Kansas